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The Effects of Anxiety on the Process of Change and Substance Use Outcomes

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The Effects of Anxiety on the Process of Change and Substance Use Outcomes

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Dedication

To my wife, children, parents, and siblings who have supported and encouraged me throughout this journey. Without your love none of this would be possible. You each inspire me and remind me of what truly matters.

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The Effects of Anxiety on the Process of Change and Substance Use Outcomes

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Anxiety and substance use disorders rank among the most common and difficult to treat co-occurring psychiatric conditions in the Western world. This dissertation sought to better understand the relationship between these disorders and how they impact one-another. To meet this aim, this dissertation explored data from a study conducted by Velasquez and colleagues (in press), known as Project TIP (Traumatic Injury Prevention). Because Project TIP demographics were similar to demographics found among the military, this dissertation was able to draw parallels between the two populations and generate findings applicable to both the general public and the military.

This study addressed two primary questions. First, does anxiety impact substance use outcomes; and second, how does anxiety impact the process of change for substance use? T-tests, general linear model (GLM) profile analyses, GLM repeated measures analyses, and latent growth curve analyses were used to test hypotheses that: 1) increased anxiety would negatively impact substance use outcomes; 2) anxiety and non-anxiety groups would experience substance use change differently; and 3) those with anxiety would differ in their trajectory (degree of change) in accordance with Transtheoretical Model (TTM) constructs over time.

Several key findings emerged from this dissertation. The first was that anxiety's impact on substance use was drug dependent, which indicates future research should compare specific

substances or categories of substances, rather than lumping all substances into a single category. Additionally, the two groups experienced change in different ways in accordance with TTM constructs, which were also substance dependent. Primarily, the anxiety group maintained a higher state of readiness to change across the study, but never overcame their perceived cons for change or temptations to return to use. Overall, while both groups' substance use improved to a similar degree, prior research suggests that because the anxiety group reported an overall higher readiness to change, the anxiety group could have changed at a greater rate, had their self-efficacy concerns been addressed. Therefore, clinicians should avoid the "one size fits all" approach and endeavor to tailor treatment regimens for those with anxiety.

Table of Contents

List of Tables

List of Figures

I. INTRODUCTION

Of all the psychiatric disorders, few are as prevalent as substance use (alcohol and other drug) disorders (SUD) and anxiety disorders (AD) (Grant et al., 2004). In the United States, lifetime rates are estimated to be 14.6% for SUD and 28.8% for AD (Kessler et al., 2005). ADs and SUDs are among the most common psychiatric conditions in the Western world, affecting every demographic group and exacting a profound cost on individuals and society as a whole. For the individual, these costs include negative impacts on employment opportunities, harm to personal and professional relationships, and an overall decrease in quality of life. Meanwhile, society also feels the burden through increased criminal activity, loss of labor, and significant strains on over-burdened medical and mental health systems (Rippeth, 2007; Simpson et al., 2010). These concerns are further compounded by the fact that SUDs and ADs often occur together (Wyman & Castle, 2006).

Decades of research show that SUDs and ADs co-occur at far greater rates than would be expected by chance (Smith & Book, 2008). Also, findings clearly reveal that the presence of an AD or a SUD is also a risk factor for the other disorder, which both epidemiological and clinical samples demonstrate (Kushner, Krueger, Frye, & Peterson, 2008; Kushner, Sher, & Beitman, 1990). As a result, researchers and clinicians have sought to examine this co-morbid relationship, particularly due to its high prevalence, developmental and maintenance characteristics, clinical impact, and unique treatment factors (Smith & Book, 2008).

Problem Statement

Despite the undeniable individual and societal impacts observed as a result of these co-occurring conditions, research in this area remains insufficient, especially in regard to providing treatment recommendations for dually diagnosed patients. For example, researchers have yet to

reach a consensus on diagnostic procedures for either disorder, which approaches or models are most effective for treating them, or whether these conditions should be treated simultaneously or sequentially (Smith & Randall, 2012). In part, this lack of consensus likely remains due to the current focus of research on seeking effective treatments for the two disorders separate from one another. Therefore, to further address co-occurring ADs and SUDS, it will be necessary to examine the nature of each disorder's impact on the other, particularly in regard to processes of change. Furthermore, specific subpopulations are likely to be far more affected by the comorbidity of these conditions than others. For instance, members of the military, who are significantly more prone to a lifetime occurrence of substance abuse and anxiety disorders than the general population (Bray et al., 2010; Lane, Hourani, Bray & Williams, 2012), would greatly benefit from increased attention to comorbid ADs and SUDS. Therefore, this dissertation includes a discussion of the military as a target subpopulation.

Of the many theoretical approaches to understanding SUDs and behavior change, one of the most prominent is the Transtheoretical Model (TTM) of behavioral change. This dynamic model describes behavior change though a biopsychosocial approach and is highly effective at predicting behavior change in SUDs and many other problems (Prochaska & DiClemente, 1984), making this model ideal for the purposes of this dissertation. Guided by Prochaska and DiClemente's (1984) TTM, this dissertation examines the co-morbid relationship between anxiety and substance use disorders, particularly in regard to the processes of change as described in the TTM. Specifically, this dissertation endeavors to address how anxiety relates to substance use outcomes.

To this end, this dissertation will first describe substance use and anxiety disorders in detail, including comorbid etiology and treatment. Next, gaps found in the literature will be

discussed, followed by several research questions and accompanying hypotheses. Lastly, the paper describes the statistical methods used to address the research questions and accompanying hypotheses in order to explore the impacts of anxiety on substance use outcomes, particularly in regard to the processes of change described in the transtheoretical model.

TRANSTHEORETICAL MODEL (TTM)

In the 1980s by Prochaska and DiClemente (1984), developed the transtheoretical model as a theory of behavior change that has successfully predicted change in a variety of situations including alcoholism treatment (Prochaska et al., 2004), smoking/tobacco cessation (Wagner, Burg, & Sirois, 2004), cocaine addiction group treatment (Velasquez et al., 2001), STI screening (Chacko et al., 2003), and safer sexual behaviors (White et al., 2001; Redding et al., 1996). The model was created by integrating processes and principles of change from across leading theories of behavior change, which is why it is called the transtheoretical model (Prochaska, DiClemente, & Norcross, 1992). The TTM approaches behavior change as a dynamic, rather than static, process. In other words, rather than only focusing on behavior change when the client is actively pursuing change, this model demonstrates a framework for understanding, measuring, and intervening in behavior change throughout the change process from the period before change has commenced to the period when change is being maintained (Marshall & Biddle, 2001; Velicer et al., 1998). TTM contains several core constructs including *stages of change, processes of change, decisional balance,* and *self-efficacy* and *temptation.*

Stages of Change. TTM describes behavior change as an internal model that transpires over time through six stages of change. These are *precontemplation, contemplation, preparation, action, maintenance,* and *termination*, although the literature generally cites only the first four stages as the primary stages of change (Prochaska, 2013).

Precontemplation. This is the first stage in the process and accounts for the point at which individuals are not intending to take action toward making a change in the foreseeable future. This stage is often misunderstood to mean that these people do not want to change. One reason individuals remain in this stage is due to a lack of awareness of the health or other negative consequences of a behavior. Additionally, they may be demoralized about their abilities to change, possibly having failed to change a behavior in the past. In other words, they may want to change, but they doubt their ability to change (Prochaska, 2013; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997).

Contemplation. This stage describes individuals who are thinking about change but have not yet decided whether or not they will change. These individuals are likely aware of the benefits of changing, but may also be aware of the cons, such as giving up benefits of the behavior, or perhaps facing failure. In this stage, individuals continually weigh both the pros and the cons of behavior change (Prochaska, 2013; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997; Velasquez et al., 2015).

Preparation. In the preparation stage, individuals have determined that the pros of change outweigh the cons (Velasquez et al., 2015) and intend to take immediate action. Ensuring the individual is sufficiently equipped to make the desired change is essential at this stage. The more prepared an individuals are in this stage, the more likely they are to reach their goal (Prochaska, 2013; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997; Velasquez et al., 2015).

Action. The action stage is typically overt and observable, and elements of change are evident as individuals have taken concrete actions (Velasquez et al., 2015). For example, a smoker will have stopped smoking, or someone desiring to lose weight will have begun

exercising. This is both the busiest and hardest stage for individuals. They must remain focused to keep from regressing or returning to an earlier stage. According to Prochaska and DiClemente (1984), individuals who are the most successful at making a change work the hardest in the action stage for approximately six months, which they believe represents the steepest part of relapse curves across addictions. Accordingly, the action stage is defined as having engagements in the new behavior for at least 6 months (Prochaska, 2013; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997; Velasquez et al., 2015).

Maintenance. This stage is described as the point at which people have completed the action stage and have sustained the desired behavior change. . It is expected that during this stage individuals will not feel the work is as difficult, but they will need to be prepared to cope with the continual possibility of relapse. Possible causes of relapse include intense feelings of anxiety, depression, loneliness, boredom, or stress, and these feelings can often trigger unhealthy coping mechanisms contributing to a relapse (Prochaska, 2013; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997; Velasquez et al., 2015).

Termination. This stage is achieved when an individual no longer experiences significant temptations to relapse and is confident they will never return to their previous behavior. Ideally, the individual will have adopted new healthy behaviors that have become automatic. At this point, change efforts may be channeled into enhancing other aspects of the individual's life. However, this stage of change is not always achieved and many individuals will remain in the maintenance stage, perhaps for their entire lifetime (Prochaska, 2013; Prochaska & DiClemente, 1982; Prochaska & Velicer, 1997).

Processes of Change. Processes of change are the covert and overt activities that people use to progress through the stages of change (Prochaska & Velicer, 1997) and act as a driving

force inducing behavior change (Velasquez, Crouch, Stephens, & DiClemente, 2015). According to the TTM, most individuals who effectively enact a behavior change use multiple change processes, whether attempting to change with or without therapy (DiClemente & Prochaska 1982; Velasquez et al., 2015). In 1988, Prochaska, Velicer, DiClemente, and Fava demonstrated that a large degree of change could be attributed to 10 statistically separate processes of change described as experiential (thought oriented) or behavioral (action oriented) processes. The experiential processes include 1) consciousness raising, 2) dramatic relief, 3) self-reevaluation, 4) environmental reevaluation, and 5) self-liberation. The behavioral processes are: 1) social liberation, 2) counterconditioning, 3) stimulus control, 4) contingency management (also referred to as reinforcement management), and 5) helping relationships (Prochaska & Velicer, 1997). Each of these change processes and their associations with the stages of change, are further described in Table 1.1 below.

Table 1.1

The Experiential and Behavioral Processes of Change and Their Associated Stage of Change

Stages of Change	**Experiential Processes** *(generally used in early stages of change)*	
Precontemplation/Contemplation	*Consciousness Raising*	Increasing awareness of the need to change
	Dramatic Relief	The strong reaction of individuals who encounter warnings about their unhealthy behavior
	Environmental Reevaluation	Reappraisal of the impact of the behavior on the environment or others
Contemplation	*Self-Reevaluation*	Reexamination of the behavior and how it affects his or her life
	Social Liberation	Noticing how changes in society and environment make it easier to change the behavior; noting how the behavior is viewed by general society and how society encourages healthier options
	Behavioral Processes *(generally used in later stages of change)*	
Preparation	*Self-Liberation*	The belief that one can change and committing to make a change
Action/Maintenance	*Stimulus Control*	Making changes in one's environment to support behavior change
	Counter Conditioning	Substituting new behaviors for the problematic behavior that one is working to change
	Contingency (or reinforcement) Management	Rewarding oneself for not engaging in the target behavior
	Helping Relationships	Identifying relationships in one's life that are supportive of the behavior change

Sources: Prochaska & Velicer, 1997; Velasquez, Crouch, Stephens, & DiClemente, 2015; Velicer, Prochaska, Fava, Norman, & Redding, 1998

Decisional Balance. Decisional Balance (DB), reflects the process by which individuals weigh the pros and cons of engaging in change. Decisional conflict between the pros and cons can often lead to profound ambivalence, which can result in a lack of change. However, in cases where an individual already perceives more cons for change compared to pros for change, increasing ambivalence can actually facilitate change. In either case, for change to occur

individuals must assign more value to the pros than the cons of change. As individuals identify more pros than cons they will advance from precontemplation into each of the other stages of change (Velasquez et al., 2015).

Self-Efficacy (also referred to as Confidence). Self-efficacy, which was integrated from Bandura's self-efficacy theory (Bandura, 1977), is the situation-specific confidence people have that they can cope with high risk situations without relapsing to their unhealthy or high-risk habit. This construct commonly is low in initial stages of change and increases in later stages.

Temptation. Temptation reflects the intensity of urges to engage in a specific habit when in the midst of difficult situations. Prochaska and Velicer (1997) state that efficacy to cope with high-risk situations protects against relapsing in those situations (e.g., using a substance). They indicate that early research has identified up to 16 high-risk categories of relapse-determinants that occur in intrapersonal and interpersonal situations. Although the number of characteristics that distinguish the different clusters varies from study to study, most reported relapses fell into three categories: negative emotional states, interpersonal conflict, and social pressure. The model speculates that the probability of relapse will decline as an individual's ability to cope with high-risk situations increases (Prochaska & Velicer, 1997; Velicer, DiClemente, & Prochaska, 1990).

Key Concepts and Terms

Specific diagnostic criteria for SUD and AD in this dissertation are based on the *Diagnostic and Statistical Manual of Mental Disorders*, fourth edition, text revision *(DSM)-IV-TR* (American Psychiatric Association [APA], 2000). Although the *DSM-5* replaced the DSM-IV-TR in 2015, the majority of the literature cited in this dissertation occurred prior to this transition. Changes to the *DSM*-5 include different terminology for mental and substance use

disorders (i.e., substance use disorder has replaced substance abuse and dependence) and qualifying criteria (e.g., symptoms).

Changes in criteria for anxiety disorders were generally minor from the *DSM-IV-TR* to the *DSM-5*. Specific differences between the two diagnostic manuals that are directly relevant to this dissertation are reviewed in the following chapters. It is impractical to discuss others in detail here. A detailed list of these changes is available through *PsychCentral* and can be viewed at the following website: https://pro.psychcentral.com/dsm-5-changes-anxiety-disorders-phobias/004266.html.

SUBSTANCE MISUSE AND DISORDERS

Substance (alcohol and other drug) jargon has steadily evolved from the broad terms of consumption, abuse, dependence, and addiction, to more specific phrasing such as chemical abuse/dependence, and finally to explicit terms for each type of substance (e.g., alcohol abuse/dependence, cocaine abuse/dependence). The most commonly used distinctions among substance use behaviors come from the *DSM-IV-TR*, which employs the terms *substance use, misuse, abuse, and dependence* (APA, 2001). Each term warrants further discussion.

Substance Misuse. Substance misuse indicates use outside of recommended guidelines. For instance, in the case of alcohol use, it refers to drinking behavior that exceeds recommended drinking limits. These behaviors are often referred to as hazardous, binge, and heavy drinking (NIAAA, 2000; Reid, Fiellin, & O'Connor, 1999). By this definition, drug misuse is any use beyond recommended guidelines, which in the case of illicit drugs is zero.

However, the definition of using a substance beyond recommended guidelines (limits) can be somewhat nebulous and is often contested. For instance, in the United States, the Substance Abuse and Mental Health Services Administration (SAMHSA, 2011) describes binge drinking as drinking five or more drinks within a couple hours of each other on at least one day a month. However, in the United Kingdom, binge drinking is more vaguely described as too much alcohol over a short period of time, e.g., over the course of an evening, and is typically drinking that leads to drunkenness (Department of Health for Culture, Media and Sport, 2007).

SUBSTANCE ABUSE. As with substance misuse, there are several definitions of substance abuse. The World Health Organization (2011) defines substance abuse as the harmful or hazardous use of psychoactive substances, including alcohol and illicit drugs, and the *DSM IV-*

TR defines it as, "…a maladaptive pattern of substance use manifested by current and significant adverse consequences related to the repeated use of substances" (APA 2001, p. 198).

In distinguishing between misuse and abuse, misuse may be defined as using a substance in a manner that causes a detrimental effect/s in some area of a person's life, while abuse is more specifically defined as the continued use of a substance despite the occurrence of significant detrimental effects (Stevens & Smith, 2013). The *DSM-IV-TR* identifies the areas in a person's life where this could occur in terms of health, social (e.g., family), vocational, school, and/or economic difficulties (APA, 2001).

SUBSTANCE DEPENDENCE. According to the *DSM-IV-TR* (APA, 2001), substance dependence is defined as "a maladaptive pattern of substance use leading to clinically significant impairment or distress" (p. 110). To meet diagnostic criteria for a dependence disorder, an individual must manifest three or more of the following within a 12-month period:

1. Tolerance, as defined by either
    a. a need for markedly increased amounts of the substance to achieve intoxication
    b. markedly diminished effect with continued use of the same amount of the substance
2. Withdrawal, as manifested by either
    a. The characteristic withdrawal syndrome for the substance
    b. The same (or a closely related) substance is taken to relieve or avoid withdrawal symptoms
3. The substance is often taken in larger amounts or over a longer period of time than intended
4. There is a persistent desire or unsuccessful efforts to cut down or control substance use

5. A great deal of time is spent in activities necessary to obtain the substance
6. Important social, occupational, or recreational activities are given up or reduced because of substance use
7. The substance use is continued despite knowledge of having a persistent or recurrent physical or psychological problem that is likely to have been caused or exacerbated by the substance

Most recently, in the *DSM 5* (APA, 2015) diagnoses of *substance abuse* and *substance dependence* have been consolidated under the single term, *substance use disorder*. Under this umbrella term, diagnoses include specifiers of mild, moderate, and severe and should be specific to the type of substance the individual is using, e.g.,. alcohol use disorder, severe. These terms as well as a description of their origins as defined by the World Health Organization (WHO), the American Psychiatric Association (APA), and the Substance Abuse and Mental Health Services Administration (SAMHSA), are described in detail in Table 1.2 below.

Table 1.2

Substance use definitions

Term	Definition	Source	DSM Version
Substance Misuse	Use of a substance for a purpose not consistent with legal or medical guidelines.	WHO, 2006	NA
Substance Abuse	A maladaptive pattern of substance use leading to clinically significant impairment or distress.	DSM-IV-TR, 2000	DSM-IV-TR
Substance Dependence	A cluster of physiological, behavioral and cognitive phenomena in which the use of a substance or a class of substances takes on a much higher priority for a given individual than other behaviors that once had greater value. A central descriptive characteristic of the dependence syndrome is the desire (often strong, sometimes overpowering) to take psychoactive drugs (which may or may not have been medically prescribed), alcohol, or tobacco.	WHO, 2011	DSM-IV-TR
Substance Use Disorder	Substance use disorders occur when the recurrent use of alcohol and/or drugs causes clinically significant impairment, including health problems, disability, and failure to meet major responsibilities at work, school, or home.	SAMHSA, 2014	DSM-5

While each of the above definitions is relevant to the discussion of substance use, using so many terms in this dissertation would be impractical. Therefore, the term *substance use disorder* (SUD) is used to describe substance use behavior that meets thresholds for diagnostic criteria in the *DSM IV* (including abuse and dependence) or *DSM* 5, while substance misuse will be reserved for describing behaviors that do not meet diagnostic thresholds, such as binge or heavy drinking. The choice to use the terms substance use disorder (SUD) and substance misuse does not imply that other terms do not have validity; it is merely a way to apply terminology and meanings consistently throughout the text.

Another topic that requires discussion is the specification of the types of substances discussed in this dissertation. Here, the reader should be aware of the differences between the terms substances, drugs, illicit drugs, and alcohol.

SUBSTANCE VS DRUG. There can be confusion between the terms *substances* and *drugs*, which are often used interchangeably in the literature. While the term "substance" broadly includes all drugs and other sources of harmful elements such as alcohol, inhalants, solvents, and naturally occurring plants (McNeece & DiNitto, 2012), it is still necessary to distinguish a drug from other substances. Part of the confusion lies in the fluidity of the definition of drug, which constantly shifts due to changes in the law, differences in cultures, and overall classification of substances such as foods, poisons, beverages, medicines, and herbs (Stevens & Smith, 2013).

Stevens and Smith (2013) define a drug as, "any nonfood substance whose chemical or physical nature significantly alters structure, function, or perception (vision, taste, hearing, touch, and smell) in the living organism" (p. 18). In this sense, the legality of a substance does not determine whether it is defined as a drug. For instance, alcohol, nicotine, and caffeine can be obtained legally but are considered drugs in the same way as illicit drugs such as marijuana.

In accordance with this definition, the focus of unhealthy behavior is placed on the user, rather than on the substance. For instance, a drug user or substance abuser is a person who intentionally takes legal or illegal drugs to alter his or her functioning or state of consciousness. In effect, any psychoactive substance, whether legal or illegal, can be abused. Of course, while drugs can refer to countless substances fitting the above description, they generally refer to illicit substances and non-medically used prescription medication (NSDUH, 2015). This dissertation focuses on three specific categories of substances: *alcohol* (which adults can obtain legally),

marijuana (which can be obtained legally in some states for medical and/or recreational purposes), and *illicit drugs* (which cannot be obtained legally anywhere in the United States).

Categories of Substances & Epidemiology

There is no shortage of articles describing the effects of substance use throughout history. In fact, a search of the terms 'substance use, substance abuse, and substance misuse' produced 249,000 articles with 23,900 of them having been published in the past 10 years. Findings from this volume of literature show that substance use and related problems are not confined to any single demographic and can affect people of any age, sex, race, ethnicity, religion, socioeconomic status, and geography (Rippeth, 2008). Furthermore, the negative impacts of substances are far reaching and include mental, physical, and sociological concerns.

One issue that is sure to plague readers concerns the natural origin of substance abuse/dependence. For instance, one might question whether it is a disease of the body, a bad habit, or simply a moral turpitude (McNeece & DiNitto, 2012). Among these possibilities, theorists have attributed substance abuse causes to genetics, culture, and even the devil. Unfortunately, as this question has persisted through decades of research without any clear answer, no answer can be divined in this text. Rather, the paper explores a variety of possible correlates of abuse and dependence for each specified substance category.

ALCOHOL. Alcohol, which can be considered both a substance and a drug, belongs to a class of chemicals called central nervous system (CNS) depressants. More specifically, it is a chemical compound that when ingested has the pharmacological property of altering the functioning of the central nervous system (McNeece & DiNitto, 2012). Although there are several types of alcohol, ethyl alcohol or ethanol is the type meant for human consumption. These beverages generally contain ethyl alcohol (C_2H_2OH), congeners, (by-products of

fermentation), colorings, flavorings, and water (Levin, 1989). According to the Centers for Disease Control and Prevention (CDC, 2017), one standard drink is equal to 14.0 grams (0.6 ounces) of pure alcohol. Generally, this amount of pure alcohol is found in:

- 12-ounces of beer (5% alcohol content)
- 8-ounces of malt liquor (7% alcohol content)
- 5-ounces of wine (12% alcohol content)
- 1.5-ounces or a "shot" of 80-proof (40% alcohol content) distilled spirits or liquor (e.g., gin, rum, vodka, whiskey)

The production, distribution, sale, and use of alcohol is regulated throughout the world, and more heavily in the United States than in Europe (particularly in regard to age restrictions). With its allure of pleasurable promises, especially as advertised by the alcohol industry, it is widely used. For instance, in 2012 the World Health Organization (WHO) published estimates of alcohol consumption of those age 15-years and older. From 2003 to 2005, the average annual consumption of pure alcohol in the United States was almost 2.5 gallons per capita.

Unfortunately, a fair amount of this drinking falls into the categories beyond the recommended drinking limits. In 2016, the Substance Abuse and Mental Health Administration (SAMHSA) observed that of the 138.2 million current alcohol users in the US, nearly half (48.2%) reported binge alcohol use (5 or more drinks within a couple of hours of each other, at least one day a month) with approximately, 5.8% (1.4 million) of these falling between the ages of 12-17, and 39% (13.6 million) between the ages of 18-25 (SAMHSA, 2016).

Although plenty of literature indicates that any alcohol consumption comes with some risk, those who engage in excessive consumption face significantly greater negative consequences. For instance, the WHO (2012) has identified alcohol as a causal factor in 60 types of diseases and injuries and a component cause in 200 others. The WHO further identifies that

alcohol accounts for 4% of all fatalities world-wide, which is more than are caused by HIV/AIDS or tuberculosis, and is the leading risk factor for death among males aged 15-59.

Beyond the physical risks associated with excessive drinking are the social issues. These include traffic accidents (drinking while under the influence and 'road rage'), violence, child neglect and abuse, and work place absenteeism. Additionally, an array of risk factors are associated with alcohol use, particularly in young people, such as smoking, illegal drug use, risky sexual behavior, disruptive behavior, depression, anxiety, eating disorders and obesity, and suicidal and homicidal behaviors (Newbury-Birch et al., 2009).

ILLICIT DRUGS. Illicit drugs are any type of drug prohibited by law and include CNS depressants, stimulants, opiates, and hallucinogens. As each is further explained, the reader will undoubtedly observe that some drugs listed below are not explicitly illicit, however, these drugs may become illicit through misuse or abuse.

The following definitions are as cited from McNeece & DiNitto (2012). The first classification is Central Nervous System (CNS) depressants, which are commonly referred to as sedative-hypnotics. These drugs are often used medically in the induction of anesthesia and the reduction of anxiety. Alcohol is a CNS depressant. The most commonly known illicit drug within the CNS category is cannabis (marijuana). However, because of the complex nature and magnitude of its influence, cannabis will be discussed separately from other illicit drugs. Opiates are substances such as heroine, morphine, codeine, opioids, and synthetic morphine-like substances (pethidine, methadone, dipipanone). Small doses will produce an effect similar to that of the CNS depressants, but with somewhat less impairment of the motor and intellectual process (dug text, 2001). The next category, CNS stimulants, are drugs that in small doses produce an increased sense of alertness and energy, elevated mood, and decreased appetite but can be fatal

in large doses. Common to this group are cocaine, amphetamines, methamphetamines, and amphetamine-like substances (Ritalin and Preludin).

Finally, hallucinogens have the capacity to induce altered perceptions, thoughts, and feelings. Some common types of hallucinogens include Lysergic acid diethylamide (LSD), mescaline, and "magic mushrooms" (which contain the ingredient psilocybin). Furthermore, volatile solvents (gasoline, benzene, and trichlorethylene), can also produce effects similar to CNS depressants and hallucinogens when their vapor is inhaled (McNeece & DiNitto, 2012).

Illicit drug use trends in the US show a dramatic increase in the last decade. In 2007, approximately 8% (20 million) of Americans used illicit drugs in 30 days prior to the survey (SAMHSA, 2008) compared to roughly 10% (27 million) in 2015 (SAMHSA, 2016). Of those who reported illicit drug use in the 2015 survey, the majority reported using either marijuana or another illicit drug along with marijuana. The remainder, about 6.9 million users, reported using psychotherapeutics non-medically, including pain relievers (3.8 million), cocaine (1.9 million), tranquilizers (1.9 million), stimulants (1.7 million), and sedatives (.4 million). However, no single category of drug accounts for the increase of overall rates of drug use as all categories of drug use were up from 2007.

It is well known that illegal drug use can negatively impact an individual and even groups of individuals as it confers a substantial burden on families, social networks, and society as a whole through violent and property crime, incarceration, poverty, and homelessness. Although illicit drug use in itself has demonstrated negative effects, those who develop drug use disorders (DUDs) are at increased risk. For this group, illicit drug use is positively associated with significant impairment in major life roles and increased risk for neuropsychological deficits, diminished quality of life, and infectious diseases (Grant, Saha, & Ruan, 2016).

Additionally, those that engage in illicit drug use increase their chances of experiencing or causing physical harm (Eaton et al., 2013). In a nationally representative 20-year follow up study, it was observed that drug users suffered increased risk for suicide, poisoning, homicide, unintentional injury, and over-all increased mortality rates, which were considerably increased for heroin and cocaine users (Walker, Pratt, & Druss, 2017).

In summary, while alcohol misuse and disorders are more prevalent, i.e., they impact a greater number of individuals, the actual consequences of alcohol abuse and illicit substance use are similar to each other. However, illicit drug users also face other increased risks, including HIV/AIDS, hepatitis, and criminal behavior related to the acquisition and sale of illicit drugs in addition to a wide range of other risk behaviors (Stevens & Smith, 2013). Ultimately, illegal drug use makes users vulnerable to substantially greater rates of long-term disability and excess mortality (Degenhardt et al., 2013; Whitford et al., 2013).

MARIJUANA. Cannabis, or marijuana, which is also known as Indian-hemp, hash, pot, herb, weed, grass, widow, ganja, or dope, is the most commonly used illicit drug (McNeece & DiNitto, 2012). Cannabis refers to the plant belonging to the family *Cannabaceae*, the genus *Cannabis*, and the species *Cannabis sativa*, and possess psychoactive effects. More than 70 psychoactive compounds called "cannabinoids" have been identified in cannabis, among which tetrahydrocannabinol (THC) accounts for most of the psychological and physical effects, and its content is often used as a measure of sample potency (Leung, 2011).

Although marijuana falls within the definition of an illicit drug (as described above), it is referred to separately here for two reasons. The first is owing to the new and seemingly ever-changing fabric of cannabis laws in the United States. Under federal law, marijuana is still federally considered a Schedule I substance, meaning that is not recognized as having any

medical use; however, as of 2016, 26 states have legalized marijuana use for medical and/or recreational purposes ("State Marijuana Laws", 2017).

Though it is too soon to accurately measure effects on the population as a result of legalizing consumption for recreational use, we can see some of the effects of legalizing marijuana for medical use. For instance, O'Connell and Bou-Matar (2007) report that by 2007, in Washington state, up to 2,000 licensed physicians had begun prescribing medical cannabis, and at the same time, California, the first state to legalize medical marijuana use (in 1996), reported that 350,000 patients already possessed a physician's recommendation to use cannabis (Ammerman et al., 2015). However, we do not know if this has been helpful or harmful to medical users.

In part, marijuana's growth in popularity comes from the growing public view that marijuana's effects are relatively benign. However, ample literature suggests otherwise. Though no fatalities have been identified as solely attributable to a marijuana overdose, observed side effects of marijuana use include increased heart rate and systolic blood pressure, conjunctival injection, dry mouth, orthostatic hypotension, increased appetite, increased thirst, drowsiness, insomnia, anxiety symptoms, panic attacks, short-term memory loss, hallucinations, and ataxia (Wang, Collet, Shapiro, & Ware, 2008). Ingestion of marijuana by children can result in a variety of symptoms, including drowsiness, ataxia, nystagmus, hypothermia, and hypotonia (Wang, Roosevelt, & Heard, 2013).

Another risk of marijuana use is the chance of developing a marijuana use disorder as well as increased risk of cross addiction to other substances, especially when use begins at early ages when the brain is still developing (Stevens & Smith, 2013). Research on adolescent brain development has found that brain maturation, particularly that of the prefrontal cortex, continues

into the mid-20s and can be negatively impacted through marijuana exposure (Sowell et al., 2004). Further, it is suggested that the developing adolescent brain is particularly susceptible to the negative effects of substance use, including the potential for developing substance use disorders, although a number of other factors may be involved, including genetic predisposition, environment, and mental health disorders (Giedd, 2004). Additionally , reports of increased lifetime marijuana use are positively correlated with overall lower cognitive functioning (Gonzalez & Swanson, 2012).

Other concerns about marijuana use generally depend on the amount and chronicity of use as well as on how the drug is introduced to the body. For example, likely risks of smoking marijuana include lung disease and cancer, while all types of consumption are associated with a number of physical and psychological symptoms including depression and lethargy (Stevens and Smith, 2013). Though these studies may not end the debate about the significance of the dangers associated with marijuana use, they do highlight a serious potential for harm inherent to the drug.

Another reason marijuana is discussed separately from (other) illicit drugs is in regard to the sub-population of the military discussed throughout this dissertation. Although many states have removed restrictions or enforcement of penalties for using, the military remains a staunch zero tolerance organization, and, as is the case with other illicit drug use, military members face serious consequences if they are caught using marijuana (LaKind, Sericano, & Still, 2013). In other words, while the Department of Veterans Affairs (VA) has issued a directive that permits veterans to use medical marijuana in states where it is legal without losing their medical benefits, military members remain barred from recreational marijuana use, regardless of whether or not the service member lives or is stationed in a state like California that has fully legalized marijuana use (Leung, 2011).

ANXIETY

Anxiety disorders, defined by excess worry, hyperarousal, and fear that is counterproductive and debilitating, are considered the most common form of psychiatric illness found among any age group (Simpson et al., 2010). The prevalence of anxiety disorders in the United States is estimated to be nearly 40 million, or 18% each year (Kessler et al., 2005), and their annual cost is reported to be $42.3 billion (Wittchen, 2002). Further, the Global Burden of Disease (GBD) study estimated that anxiety disorders contributed to a loss of 26.8 million years of full health in 2010 (Whiteford et al., 2013).

One possible reason ADs are so prevalent is that anxiety is deeply associated with fear, which is something we all experience. However, the terms *anxiety* and *fear* are not the same. First, *fear* is an immediate and rapidly evolving emotional response to real or perceived imminent threats in the environment. Comparatively, *anxiety* is a more sustained, heightened state of apprehension in anticipation of future threats (Remes, Brayne, Vander Linde, & Lafortune, 2015).

Stress is another term that, while subtly different, shares similarities with anxiety and fear and therefore requires discussion. According to Webster's Third New International Dictionary (1981, p. 2260), stress is defined as "a physical, chemical, or emotional factor (as trauma histamine, or fear) to which an individual fails to make satisfactory adaptation and which causes physiologic tensions that may be a contributing cause of disease." In this sense, stress can result from either fear or anxiety or it can be a contributing factor to fear or anxiety, making the distinctions and causal relationships fuzzy at best.

Notably, while each of these terms have different meanings, they share similar symptomology including physiological arousal (increased heart rate), increased alertness,

increased motor reactivity, and potentially a fight-or-flight response. In truth, when it comes to a diagnosis, it may not be possible to completely isolate the terms. For instance, fear, stress, and anxiety can be experienced on a normal to abnormal spectrum, where the abnormal indicates a clinical diagnosis (Sylvester & Pine, 2016).

In these cases, extreme types of fear can be diagnosed as phobias, while abnormal, chronic, or extreme cases of stress and anxiety result in a slew of anxiety disorders including adjustment disorders, Generalized Anxiety Disorder (GAD), Social Anxiety Disorders (SAD), panic disorders (PD) and Post-Traumatic Stress Disorder (PTSD), to name a few (Steel, Marnane, Iranpour, Chey, Jackson, Patel, & Silove, 2014; Mundy et al., 2015).

CO-OCCURRENCE

Research and clinical experience commonly show that when anxiety and substance use disorders simultaneously occur, these disorders are functionally intertwined in both their development and maintenance (Smith & Book, 2008). However, the relationship between these diagnoses is made all the more difficult to comprehend through muddled clarity of key terms. For instance, while one study may refer to the interaction between anxiety and substance use disorders as a *dual diagnosis*, another might refer to the same relationship as *co-occurring* or *comorbid*. Therefore, before discussing this topic further, these terms need clarification.

Comorbidity is used when describing two or more disorders or illnesses occurring simultaneously in the same person (Mizrahi & Davis, 2008). Comorbidity also implies interactions between the illnesses that can worsen the course of both (NIDA, 2010). C*o-occurrence* may include any combination of two or more substance use disorders and/or mental disorders identified in the *Diagnostic and Statistical Manual of Mental Disorders* that occur at the same time. While the terms *comorbidity* and *co-occurring* are often used interchangeably, there is a subtle difference. Simply, when referring to two or more simultaneously occurring disorders in the same person, either term is appropriate. However, comorbidity is more apt when discussing an interaction between diagnoses, where one disorder, disease, or illness, is expected to impact the nature of another.

Finally, *dual diagnosis* is the least commonly used term and is generally reserved for specific reference to individuals with both a clinically significant mental illness and a substance use disorder (Mueser et al., 2003). While these terms are likely to vary by field or practice, in the interest of simplification, for this dissertation, the term comorbidity will be used as a proxy for each of these terms, as has been common in the current literature (Mizrahi & Davis, 2008)

Epidemiology

The literature identifies a greater prevalence of substance users who report also experiencing anxiety, when compared to those diagnosed with a non-substance induced anxiety disorder who also report substance use problems (Wong, 2014). Data from the National Epidemiologic Survey on Alcohol and Related Conditions demonstrates these correlations citing that among respondents with a 12-month SUD, almost 18% also met criteria for a non-substance induced anxiety disorder, while about 15% of those who sought treatment for an anxiety disorder also met criteria for a SUD (Grant et al., 2004). A prominent feature of concern for those who endorse both substance use and anxiety disorders is how each seems to perpetuate the other (Wong, 2014). Patients endorsing both substance use and anxiety disorders also endorse greater symptom severity and impairment than those who identify only one of these disorders (Bruce et al., 2005; Driessen et al., 2001; Ouimette, Ahrens, Moos, & Finney, 1997).

Those patients with comorbid conditions also report worse treatment outcomes, report a lower willingness to engage in treatment, poorer treatment adherence, and overall poorer recovery (Ouimette et al., 1997). For instance, in a 12-year prospective study (N=3018), Bruce et al. (2005) found that the co-occurrence of SUD decreased chances of generalized anxiety disorder (GAD) recovery more than threefold. Another study (N =100) showed that anxiety comorbidity was associated with increased alcohol use relapse even though treatment completion was 69% among these individuals compared to 40% for those diagnosed solely with a SUD. However, the extent of the relationship between anxiety disorders and SUD remains unclear owing to the small sample sizes of recent studies as well as the range in severity and complexity of each diagnosis (Driessen et al., 2001).

In an attempt to better describe how relationships between SUDs and ADs are developed and maintained, several hypotheses have been developed. Often referred to as *primary pathways to comorbidity*, Smith (2008) describes three proposed causal models that are continually cited in the literature: *the self-medication model*, *the substance-induced anxiety model*, and *the common factor model* (Smith & Book, 2008; Smith & Randall, 2012; Stewart & Conrod, 2008).

The *Self-Medication Model*, an AD pathway to SUD, suggests individuals use drugs or alcohol to cope with psychological distress, which ultimately results in a comorbid SUD (Chilcoat & Breslau, 1998; Khantzian, 1985). In this situation, anxiety precedes the SUD, and this arrangement is the scenario most often borne out in research studies. As one example, analyses of the National Comorbidity Survey showed that 79.3% of those who exhibited a comorbid AD and SUD indicated their anxiety symptoms existed prior to their substance misuse (Kessler, Chiu, Demler, & Walters, 2005).

However, a significant limitation of this hypothesized pathway persists. While the model may account for the development of comorbidity, it does not adequately account for the maintenance of co-occurrence that may be affected by neurobiological changes chronic substance users experience. In other words, the self-medication hypothesis may explain the development of SUD for some, but it does not explain the continued use and poor recovery rates from problematic substance use after psychological symptoms are reduced (Wong, 2014).

The *Substance-Induced Anxiety Model*, also known as *the susceptibility hypothesis*, posits that substance use can promote the development of an anxiety disorder (Chilcoat & Breslau, 1998). In this model, the explanation for comorbidity is that anxiety is a consequence of heavy, prolonged substance use (Smith & Randall, 2012). This theory proposes that repeated substance use reduces the threshold for the development of psychological symptoms. Then, in what is

sometimes described as a ‘kindling process,’ a substance user experiences repeated withdrawal, which leads to a hyper-responsive central nervous system that is susceptible to heightened panic and anxiety.

Additionally, withdrawal periods can induce changes in anxiety producing systems in the brain known as ‘hyperexcitability,’ which occurs through over-stimulation of the limbic and norepinephrine systems (Kushner et al., 2000; Marshall 1996), that are involved in producing panic attacks (Graeff & Del-Ben 2008; Marshall 1996). The user, in turn, increases substance use to cope with ever-increasing symptom severity (e.g., Kushner, Sher, & Beitman, 1990).

While the limitation of the self-medication model was that there were no noticeable reductions in substance use after treating anxiety, a similar statement may not be able to be made about the substance-induced anxiety model. In fact, this model specifically predicts that abstinence from alcohol should result in reduced anxiety symptoms, and data seems to support this hypothesis. For example, in a study of 53 residential substance abuse patients who participated in alcohol treatment, 69% of participants who reported no relapse at follow-up (approximately 127 days following initial treatment) subsequently reported decreased anxiety symptoms (Kushner, Abrams, Hanson, Brekke, & Sletten, 2005). This finding is supported in another study where 171 male veterans reported that anxiety symptoms decreased rapidly during inpatient alcohol treatment, and participants who reported experiencing a relapse also reported significantly higher rates of anxiety symptoms (Brown Irwin, & Schuckit, 1991). Despite these findings, few studies have examined this relationship. More research is needed before these findings can be applied more broadly.

Unlike the previous two models, the third model, the *Common Factor Model*, does not identify a direct causal relationship between the two disorders. Rather, it suggests that a third

variable accounts for the presence of both disorders. Although it is difficult to accurately account for a full range of common factors, the most consistently proposed third variables are genetic factors and personality traits such as anxiety sensitivity (Smith & Randall, 2012).

Though family and twin studies support the role of genetic factors as a cause of these disorders (e.g., Merikangas Risch, & Weissman, 1994, 1996; Tambs, Harris, & Magnus, 1997), another common factor could be anxiety sensitivity. Specifically, anxiety sensitivity is a tendency to fear bodily sensations associated with the experience of anxiety, which is then interpreted as signs of an impending negative outcome (Reiss, Peterson, Gursky, & McNally, 1986). In effect, it is hypothesized that anxiety sensitivity functions as a moderator where those with high anxiety sensitivity are more motivated to avoid anxiety sensations and to use substances as an avoidance strategy (Reiss, 1991). Additionally, those high in anxiety sensitivity may experience a more robust anxiolytic effect from substance use (Stewart & Pihl, 1994).

Since the majority of literature on this model examines the effects of comorbid anxiety and alcohol use disorder, likely because it is much more common (Wong, 2014), it is unclear whether this particular model is applicable to other substance use disorders. Regardless, this model provides an interesting perspective on the cause and maintenance of comorbidity and could potentially play a key role in future advances.

MILITARY SUB POPULATION

While SUDs, AUDs, and comorbidity between the two are clearly significant concerns facing the general population, some groups face even greater risk of developing these disorders. One such group is the military, which has been identified as having increased rates of SUDs, ADs, and co-morbidity (Bray et al., 2010). Because military members are recruited directly from the civilian population, it would seem logical that the two groups would share similar demographics. However, several distinct differences between the general civilian population and military members must be considered.

Notably, the military is comprised of a larger percentage of younger males than the civilian population (Bray, 1991). Additionally, military members often experience different life stressors than civilians, including deployment, overseas assignments, separation from family, and more constant oversight and supervision (Bray, Marsden, & Peterson, 1991; Lazar, 2014; Maguen, et al., 2012). Finally, the military may attract people with particular personality traits. For example, a study sponsored by the U.S. Army described a distinct difference in military members through its appeal to individuals who possess attributes such as "sensation-seeking, impulsivity, and physical aggressiveness" (Rosellini et al., 2015, p. 18).

Due to the military's unique environment and characteristics, its members may face even greater risks for SUD, AD, and comorbidity than the civilian population. As a result, this group provides unique opportunities to examine SUDs, ADs, and comorbidity, which will hopefully yield clearer findings for future prevention and/or treatment. For these reasons, the military sub-population will be examined separately from the generally civilian population in regard to both SA and anxiety.

Substance Abuse and the Military

Researchers have already identified greater prevalence of substance abuse in military members compared to civilians, especially in regard to alcohol use (MHAT, 2006). For instance, a study conducted in 1991 found prevalence of any drinking among all military personnel was about 8 to10 percentage points higher than that of civilians (Bray, 1991). A later trend study on this group of personnel showed heavy drinking increased significantly from 1998 to 2008 (Bray, 2010). The distinct conditions of military life, including living overseas, separation from family, and a greater perceived acceptance of alcohol use, may engender a unique military perspective with regard to substance use (Bray, 2010).

Another factor for increased substance use among military members is a military member's involvement in combat operations, which provides significant potential for traumatic experiences most civilians will never face (Moore et al., 2009). The military attempts to counter this increased risk for substance abuse and dependence through substance abuse prevention, identification, and treatment programs (Larson et al., 2012). A zero-tolerance policy has been enacted as an initial deterrence against illicit drug use (DOD, 2014).

Though a wide variety of treatment options are made available to military members, Larson et al. (2012), describe reasons members may conceal developing substance use disorders, including the *warrior ethos*, referring to the idea that military members may view help-seeking behavior as a sign of weakness. They neither want to admit they need help, nor want to fall into a stigmatized category of the "sick" (Larson, 2012). While the military's zero-tolerance illicit drug policy paired with frequent drug testing seem to effectively combat illicit drug use, which has dropped to a level comparable to civilian use, prescription drug and alcohol misuse has continued to rise, despite availability of military substance abuse programs (Bray, 2010).

While many theories have been offered to describe the onset and maintenance of SUDs in the military, no single theory is dominant. Researchers and clinicians continue to explore additional factors such as genetic components, personality traits, behavior, and disease and dependency models in an effort to better understand the nature of substance abuse in this population (Bray, Marsden, & Peterson, 1991; Bray et al., 2010; Bray, Spira, & Lane, 2011; Tsuang et al., 1996). For detailed comparison of these theories, see Lettieri and colleagues' (1980) book, *Theories on Drug Abuse: Selected Contemporary Perspectives*.

Anxiety and the Military

Military members are also at higher risk of developing ADs than the general populace, with prevalence rates of ADs among military members significantly higher than for civilians. ADs affect an estimated 40 million adults in the general population or about 18% of the US population each year (Kessler, Chiu, Demler, & Walters, 2005; National Institute of Mental Health, 2009) and account for nearly 30% of treatment seeking patients primary care physicians see (Maxmen & Ward, 1995). In a study of the military population's current mental health needs, Lazar (2014) identified that military members experience "internalizing disorders" such as anxiety at a rate 10% higher than civilians. In other words, military members likely face the same risk factors for developing ADs as the civilian population but also have additional risk factors due to their unique work environments. Some of these unique factors are high stress from demanding duties, frequent changes of duty and living locations, time spent away from family and loved ones, and exposure to traumatic events (Hoge, Auchterlonie & Milliken, 2006; Lovering, Proctor, & Heaton, 2013). Therefore, it is not surprising that military members have higher rates of ADs than civilians.

Beyond usual environmental risk factors, military members face increased susceptibility to SUDS, ADs, and comorbidity due to developmental, behavioral, and cognitive factors that are also unique to military members (Sirratt, Ozanian, & Traenkner, 2012). Though these differences may stem from basic personality traits such as those the US Army describes as sensation-seeking, impulsivity, and physically aggressiveness (Rosellini et al., 2015), the underlying etiology of ADs among military members is likely to involve the interplay of biological and environmental factors and is likely to be complex.

Co-occurrence of Disorders in the Military

There is no denying the significant degree of co-morbidity among military members, especially regarding ADs and SUDs. As noted, prevalence rates for both SUDs and ADs are greater than the general population, which may also indicate the likelihood of a higher rate of co-occurring ADs and SUDs. Unfortunately, it is difficult to identify the prevalence rates of co-morbid ADs and SUDs for military members as most military studies examine multiple mental disorders (e.g. depression, PTSD, and suicidality) without specifically focusing on anxiety and substance use comorbidity.

Given the lack of studies on these comorbid conditions, one may question whether it is important to examine co-morbid ADs and SUDs separate from other mental disorders. Williams et al. (2010) sheds light on this question in a study examining the differences between motivations to drink for those with depression compared to those with anxiety. He found that those with depression were distinctly different in their motivations to use alcohol than those with anxiety.

Ultimately, the literature that does exist consistently suggests that there is a higher prevalence of alcohol use disorder and anxiety disorder comorbid relationships among the

military compared to civilians. For instance, two separate studies reporting rates of AD and SUD comorbidity ranged from 33% in the general military population to over 65% for those military members seeking treatment for these comorbid disorders (Burns, Teesson, & O'Neill, 2005; Haver & Dahlgren, 1995).

Of all of the possible causal models, the self-medication model is the most often cited when discussing the relationships between anxiety and substance use among military members. However, it should be noted that most studies that explore these comorbid relationships focus primarily on PTSD and SUDs. In reviewing the studies that explore the relationship between PTSD and SUDs, common explanations are that military members are likely to experience greater exposure to trauma, which in-turn results in negative coping strategies.

Following the self-medication model, exposure to traumatic events heightens risk for SUDs. This relationship is then mediated by the occurrence of PTSD or other posttraumatic psychiatric disorders (Jacobsen, Southwick, & Kosten, 2001; Khantzian, 1999). However, given that research pertaining to the self-medication model concerning these comorbid disorders among the military is limited to PTSD and SUDs, this is a significant gap in the literature.

In further support of the self-medication model, learning-theory has also been used to explain the relationship between SUDs and ADs. In this theory, alcohol use is hypothesized to be negatively reinforcing, providing immediate and short-term relief from PTSD or other anxiety symptoms. For example, military veterans diagnosed with PTSD often report using alcohol and other drugs as a coping strategy to avoid symptoms of re-experiencing and hyperarousal (Douglas, Southwick, & Charney, 1996). Given alcohol's powerful, short-term negative reinforcement effects, it is easy to see how these individuals would fall into a pattern of frequent and excessive use, resulting in the development of a SUD.

II. THEORY & TREATMENT OF CO-OCCURRING DISORDERS

The treatment of comorbid ADs and SUDs is a pressing concern for modern treatment providers given the disorders' high prevalence and persistence. Although identifying *"the best"* treatment approach is beyond the scope of this dissertation, it is useful for the reader to have a basic understanding of current treatment models in these co-occurring disorders.

The temporal ordering of treatment has garnered particular attention. Three main categories of treatment orders most often used to treat co-morbid disorders are: 1) *sequential* (treatment of one disorder is followed by treatment of the second comorbid disorder); 2) *parallel* (also referred to as *concurrent* or *simultaneous*, in which both comorbid disorders are treated at the same time, but not necessarily by the same provider or in the same treatment facility); and, 3) *integrated treatment* (both disorders are treated, or at least monitored simultaneously, by a single qualified provider) (Kavanagh & Connolly, 2009).

Sequential Treatment

Historically, sequential treatment has been the most common approach. Treatment centers, which often specialize in specific disorders, focus on one disorder and then follow up with a referral to another treatment program to address the other comorbid disorder (Donald, Dower, & Kavanagh, 2005). In addition to being the most common approach, Kavanagh and Connolly (2009) make the case that the sequential model is also the most effective approach, particularly in cases where one disorder is clear primary and other is secondary. In this case, it is relatively easy to prioritize which treatment should come first. Moreover, this treatment model allows for the possibility that treating the primary disorder may significantly reduce the need for additional treatment of the secondary disorder.

There is also justification for treating one disorder first, even if it is not the primary disorder. For instance, typically in comorbid AD and SUD cases, the SUD is treated first, regardless of whether it is the primary disorder or not. Reasons for this are best described in a study by Back, Waldrop, and Brady (2009), where clinicians were surveyed about their attitudes about comorbid treatment. The authors found that a primary concern among clinicians was that exposing patients to traumatic memories, which often occurs through exposure therapy (particularly in treating PTSD), before treating the patients' SUD exacerbated their substance use or resulted in a relapse. Also, when a person's thinking is impaired by drug or alcohol use, it is difficult to benefit from therapy.

Though there may be many benefits of this approach, there are also limitations. For instance, a primary limitation is that it could fail to adequately address the complex interactions between the two disorders. While treating SUDs first may seem logical, it may also prove to be a futile effort if anxiety concerns are not addressed. For example, even when healthy coping mechanisms are taught in SUD treatment, anxious feelings, self-doubt, and unwelcome recurrent thoughts may continue to drive unhealthy coping strategies, such as self-medication via drug or alcohol use (Stewart & Conrod, 2008).

Parallel Treatment

In the parallel treatment approach, both disorders are treated at the same time but by two different treatment providers or teams, one for each disorder. This addresses some of the earlier stated limitations of sequential treatment. However, without continued communication and coordination between treatment providers or teams, the parallel approach could suffer from the same limitations of treating each disorder as discrete and separate. Another concern is that treatment providers may follow different policies, protocols, and theoretical approaches and may

not communicate their strategies and concerns with the other provider (Donald et al., 2005). As a result, clients may receive conflicting messages from providers rather than coordinated care.

Integrated Treatment

In this third model, a patient either receives treatment for both disorders concurrently by the same treatment provider/team, or receives treatment from two providers/teams with one provider/team continually monitoring treatment for both disorders. Integrated treatment may not mean simultaneous treatment of both disorders; rather, it entails tailoring treatment techniques to address prevalent concerns, which typically change over the course of treatment (Kavanagh & Connolly, 2009).

While integrated treatment may seem to be the most advantageous approach of the three types, there may be some drawbacks. The greatest challenge is that not all treatment providers are competent to treat or even monitor both disorders. For example, a treatment provider may be experienced in treating SUDs, but may lack knowledge or experience in treating significant trauma histories that patients with PTSD may have. Furthermore, it may be difficult to provide integrated treatments in many treatment facilities because they tend to specialize in treating a disorder such as AD but may not be equipped to address SUDs including detoxification, withdrawal, and relapse (Randall, Book, Carrigan, & Thomas, 2008).

Little research has been conducted comparing sequential, parallel, and integrated treatment approaches. Donald and colleagues (2005) identified this dearth of literature in their review of randomized clinical trials comparing the three strategies. They identified only one study that compared a parallel treatment model to an integrated model, the results of which suggested little difference in overall outcomes. The authors noted that patients in the integrated treatment group had higher treatment participation rates, which is particularly significant for co-

morbid AD and SUD treatment as low treatment participation is evident in both (Hellerstein, Rosenthal, & Miner, 1995). Donald et al. (2005), also noted that more research is needed before conclusions can be drawn.

There is a general consensus that, given the safety concerns associated with detoxification and acute withdrawal, acute SUDs should be addressed before other treatment is introduced (Goldstein, Diamantouros, Schaffer, & Naranjo, 2006). However, there is no consensus on the ideal amount of time to wait after acute SUD treatment has been initiated before implementing anxiety treatment. In sum, research has yet to conclusively identify wheter any of the three strategies is more effective. Therefore, treating providers are left to determine the course of treatment on a case by case basis, considering the severity of disorders, presenting symptomology, availability of resources, and the patient's preferences. This dissertation aims to help practitioners with these types of decisions by providing a description of the nature of anxiety's role in substance use treatment outcomes.

Anxiety and the Transtheoretical Model

It has long been understood that a substantial barrier to behavior change is a client's anxiety, either rendering an individual incapable of making the change, or instilling doubt that change will be effective (Cattell, 1966; Spielberger, 2013). This is also the case for substance abusers who may desire treatment but fear possible outcomes. Clinicians and researchers must therefore understand the nature of fear and anxiety on motivation and readiness to change.

While no identified studies directly discuss anxiety and the transtheoretical model, research clearly articulates anxiety's impact on motivation or readiness to change, particularly in studies that examined the effectiveness of Motivational Interviewing (MI) as a treatment approach. For instance, Westra, Arkowitz, and Dozois (2009), conducted an initial controlled test

of whether adding an MI pretreatment to CBT for GAD would enhance treatment outcomes. The sample was 76 clients with a principal diagnosis of GAD. One group received a brief MI pretreatment followed by CBT (MI-CBT) and the other group received no pretreatment (NPT), followed by a 4-week wait, and then by CBT (NPT-CBT). Results showed significant group differences in GAD symptom reduction favoring the MI-CBT group. The authors concluded that adding MI pretreatment to CBT was beneficial in treating GAD for individuals with high worry severity at baseline.

Overall, there is a clear link between anxiety and SUD treatment where anxiety acts as a barrier to engagement or completion of SUD treatment. While little research has directly related anxiety to TTM outcomes, some studies show that SUD treatment outcomes are significantly tied to TTM variables. For example, participants' treatment outcomes could be predicted by their TTM scores, such as endorsements of pros versus cons (Carbonari & DiClemente 2000; von Sternberg, Velasquez, & DiClemente, 2012). As literature in this area is extremely limited, more studies of anxiety and each of the TTM variables is necessary to advance the field. .

III. GAPS IN THE LITERATURE

This literature review reveals a strong association between AD and SUDs and that each disorder can negatively impact the other (Kushner, Krueger, Frye, & Peterson, 2008; Kushner, Sher, & Beitman, 1990). Yet, there is still much debate concerning the ways these disorders interact and how each disorder impacts the treatment outcomes for the other disorder. Researchers should examine the nature of anxiety's impact on substance use outcomes and investigate how the change process differs for people with anxiety compared to those without.

Taylor, Abramowitz, and McKay (2012) at least partially answered these questions in their review of recent literature on anxiety treatment. This review confirmed that about a fifth of patients drop out prematurely and a third of treatment completers are classified as non-responders. They go on to suggest that risk of premature dropout is associated with low treatment motivation (Taylor, Abramowitz, & McKay, 2010). This seems to indicate that a further understanding of the relationship between anxiety and motivation, or readiness to change, could further understanding of anxiety's impact on substance use disorder treatment.

Given that the literature suggests significant differences in substance use outcomes when anxiety is or is not present, we must ask where in the process of change anxiety has the most impact. For example, does anxiety impact how an individual weighs pros and cons of changing, or how an individual rates confidence or temptations in situations of substance use? To address these questions and advance understanding of the relationship between anxiety and SUDs, this dissertation focuses on anxiety's impact on the change process in relation to substance use outcomes. Specifically, substance use outcomes and the change process were examined for each of the TTM variables (i.e., *decisional balance* [DB], pros and cons; *processes of change* [POC], experiential and behavioral; and *self-efficacy* [SE], confidence and temptation; & readiness to

change obtained from the University of Rhode Island Change Assessment [URICA]) comparing those who endorse anxiety to those who do not.

This work may aid researchers and practitioners in understanding whether/how anxiety impacts substance abuse treatment outcomes as well as how the change process may differ for each group. It may also be helpful in describing the pathways to success (e.g. abstinence or reduced substance use) for those with anxiety compared to those without. Additionally, it will help in developing treatment methods that focus on the most influential TTM components to ensure the highest rate of success. It may also help to target TTM components that compensate for differences between the two groups. This knowledge will ensure future care is both efficient, by eliminating additional treatment options that may be unnecessary or even detrimental, and sufficient, by directing resources to what will most benefit clients.

IV. CURRENT STUDY

This dissertation utilized data gathered as part of a NIDA funded, single blind, randomized control trial named Traumatic Injury Prevention (TIP), conducted between 2010 and 2015 (NIH-NIDA, R01 AA022924). This study will systematically examine anxiety's overall impact on substance use outcomes as well as the overall process of changing substance use behaviors. Two groups will be compared: those who meet the threshold of having clinical anxiety symptoms based on the *Brief Symptom Inventory* (BSI) anxiety subscale cutoff score (above 62), and those who do not (a score of 62 or below). Differences in substance use outcomes between the two groups will be compared based on *percent days abstinent* (PDA). PDA is calculated as the number of days where none of the study identified substances were reported over the past 90 days. The groups will also be compared on their processes of change based on the transtheoretical model constructs.

Research Questions, Hypotheses, and Proposed Analysis

RESEARCH QUESTION 1. Does the presence of anxiety impact substance use (as measured by PDA)? Those with little to no anxiety (62 or less on the BSI anxiety subscale) will be compared to those with moderate to high anxiety (more than 62 on the BSI anxiety subscale) by examining the Percent Days Abstinent for both groups over time (dependent variables measured at baseline, three months, six months, and 12 months).

Hypothesis 1a. The anxiety group will report fewer days abstinent at baseline, 3-, 6-, and 12-months.

Analysis. Preliminary group difference tests of percent days abstinent (Independent samples T-test), and General Linear Model (GLM) Repeated Measures analyses will be used to compare the groups at baseline, 3-, 6-, and 12-months.

RESEARCH QUESTION 2. Per the Transtheoretical model, does the process of changing substance use differ for the anxiety group compared to the non-anxiety group?

Analysis will compare the process of change for those with anxiety to those who endorse little to no anxiety by examining the group's relationships with TTM components (i.e., decisional balance, self-efficacy, experiential and behavioral processes of change, and readiness) and their overall profile shape of TTM variables in relation to substance use (*cannabis* and *cocaine*) at four different time points.

Hypothesis 2a. The two groups will differ in how they engage in each TTM construct at each assessment time point (baseline, 3-, 6-, and 12-month follow-ups). It is expected that the anxiety group will report less perceived importance of pros and greater perceived importance for cons for change; less confidence in their ability to change and greater temptations to return to substance use; less engagement in both experiential and behavioral processes of change; and will score lower on their overall readiness to change compared to the non-anxiety group.

Analysis. A Profile Analysis will be used at the four time points to examine differences between the anxiety and non-anxiety group on each TTM constructs (i.e., DB, ASE, POC, and URICA).

Hypothesis 2b. The two groups will differ on their trajectory (degree of change) on each TTM construct over time. Since this is an exploratory study and research has not clearly identified where these trajectories would differ, differences are not predicted here.

Analysis. SPSS AMOS software will be used to examine and compare the rate of change on each TTM variable, DB, Processes of Change (experiential processes and the behavioral processes), and Self-Efficacy (confidence and temptation) between the two groups through SEM Latent Growth Curve (LGC) analysis. Through this procedure, each TTM construct will be

examined between the two anxiety groups across four different time points (baseline, 3-, 6-, and 12-months).

METHODS

This dissertation employs data from project TIP (Traumatic Injury Prevention), which was developed as part of a grant funded by the National Institute on Drug Abuse (R01 DA 026088). Project TIP aimed to study the possible reduction of traumatic injury by assessing the effectiveness of substance abuse treatment using Brief Motivational Interviewing (BMI). TIP was a three-group, single-blind, randomized controlled trial conducted at University Medical Center Brackenridge in Austin, Texas from March 2010 through June 2015.

Study Design and Treatment Intervention

Participants in the original project TIP study were randomly assigned to one of three groups: Brief Advice (BA), Brief Motivational Interviewing (BMI), or Brief Motivational Interviewing plus a booster (BMI+B). The BA group, or treatment as usual group, received an initial interview conducted by a study staff member, a recommendation to abstain from drug use, provision of educational material supporting that recommendation, referral to hospital or community treatment resources most likely to be beneficial to the patient, and information about relevant community healthcare agencies. The BMI group received a single 30-45 minute face-to-face individual session, using Motivational Interviewing (MI) and assessment feedback, aimed at targeting the participant's drug use behaviors. Participants assigned to the BMI+B group received the same intervention as the BMI group but also received one booster call approximately 4 weeks following the BMI intervention from the same clinician who conducted their initial intervention. BMI and BMI+B participants also received personalized feedback to collaboratively discuss the role drug use plays in their life. When patients reported being motivated to change their drug use, a change plan was developed.

All three interventions were fully manualized and audio-taped. MI training for counselors included workshops, didactic sessions, structured readings, role plays, and performance feedback and was monitored through weekly clinical supervision in both individual and group sessions. Interventions were conducted in either English or Spanish, depending on the participant's preferred language.

Sample

Project TIP participants were identified and recruited using the hospital's daily trauma registry, which is an electronic medical record of admitted trauma unit patients. To be eligible for the study, participants had to meet the following criteria: 18 years or older; presented to the hospital with a traumatic injury (e.g. a motor vehicle collision as driver, passenger, or pedestrian, or violence-related injuries including gunshot wounds, stab wounds, or other injuries related to assaults and falls); screened positive for drugs on a toxicology screen and/or gave a verbal positive of illegal drug use within 30 days prior to the traumatic injury for which they were being treated; and be available for the follow-up period. Exclusion criteria included the following: cognitive impairment; serious mental illness; high suicide risk; re-admittance for prior injury; insufficient contact information; living outside catchment area; inability to provide informed consent; and detected drug use due to medication taken as prescribed by a health professional (meaning the subject was falsely identified as using an illicit substance due to the effects of a prescribed drug on the screener).

A total of 9,072 individuals were identified through the trauma registry during the recruitment period. Of these, 5,127 hospital patients were screened for participation and 777 of these individuals met study inclusion criteria. It should be noted, that 77 participants were funneled to another study called "MARIA", which was a concurrent study being run by the same

that examined alcohol use. Ultimately, 416 patients were assigned to and agreed to participate in Project TIPS and provided written informed consent. The Institutional Review Boards at the University of Texas at Austin and University Medical Center Brackenridge approved study protocols and a Certificate of Confidentiality was obtained from NIH/NIDA (See figure 4.1 below for recruitment details).

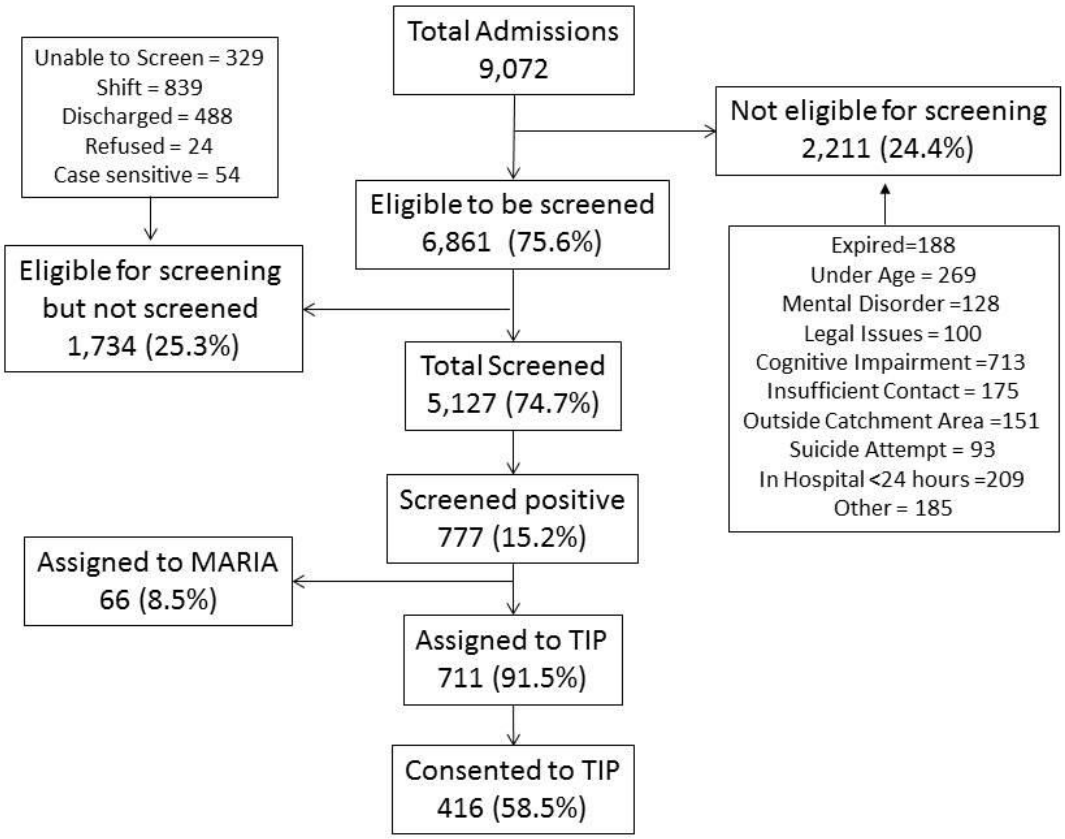

Figure 4.1. Participant Flow Chart (obtained from Project TIPS manuscript in press)

Of the original 416 participants that were identified as eligible and agreed to participate in this study, 21 were designated as pilot study participants for training purposes. As these participants were not required to complete assessments at all four time-points (baseline, 3, 6, and

12 months), they were removed from all analyses, resulting in a total *N* of 395. Finally, one participant was removed for having insufficient data to be placed in either the anxiety or non-anxiety group leaving an *N* of 394 participants included in analyses at baseline. Attrition accounted for the loss of another 43 participants over the next year, leaving a final *N* of 352 participants included in all analyses. While it is not possible to fully explain why these 43 participants dropped out of the study, T-tests revealed that at baseline there were no statistically significant differences in substance use between the anxiety and non-anxiety groups for any of the four substance categories.

Participants were more likely to be male (81%), Non-Latino (66%), White or Caucasian (62%), employed (64%), and single (62%), with an average age of 28 years old. These demographic characteristics were similar for the anxiety and non-anxiety groups. For example, anxiety group participants were more likely to be male (78%), Non-Latino (64%), White or Caucasian (63%), employed (56%), and single (62%), with an average age of 29 years old; and non-anxiety group participants were more likely to be male (82%), Non-Latino (67%), White or Caucasian (61%), employed (68%), and single (62%), with an average age of 28 years old. See Table 4.1 below for a breakdown of demographics according to treatment condition.

Table 4.1

Study Sample Demographics

Tx Group	**Brief Advice**				**MI**				**MI+Booster**			
	Non-Anxiety		Anxiety		Non-Anxiety		Anxiety		Non-Anxiety		Anxiety	
Age	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
	29.10	11..35	33.35	10.51	33.7	12.79	32.02	10.26	30.66	11.39	31.77	11.92
Gender	**Frequency *n*=89**	**(%)**	**Frequency *n*=43**	**(%)**	**Frequency *n*=90**	**(%)**	**Frequency *n*=46**	**(%)**	**Frequency *n*=73**	**(%)**	**Frequency *n*=53**	**(%)**
Male	69	(77.5)	30	(69.8)	78	(86.7)	36	(78.3)	60	(82.2)	45	(84.9)
Female	20	(22.5)	13	(30.2)	12	(13.3)	10	(21.7)	13	(17.8)	8	(15.1)
Ethnicity												
Latino	28	(31.5)	14	(32.6)	31	(34.4)	17	(37)	24	(32.9)	20	(37.7)
Race												
Asian or Other	23	(25.8)	2	(.05)	2	(.02)	3	(.07)	1	(.01)	2	(.04)
Black or African American	18	(20.2)	6	(14)	17	(18.9)	6	(13)	10	(13.7)	8	(15.1)
White or Caucasian	50	(56.2)	28	(65.1)	55	(61.1)	31	(67.4)	49	(67.1)	30	(56.6)
Employment Status												
Employed	57	(64)	21	(48.8)	63	(70)	23	(50)	50	(68.5)	36	(67.9)
Unemployed	22	(24)	15	(34.9)	14	(15.6)	16	(34.8)	16	(21.9)	9	(17)
Not in the work force	10	(11.2)	7	(16.3)	13	(14.4)	7	(15.2)	7	(9.6)	8	(15.1)
Marital Status												
Single, never married	60	(67.4)	22	(51.2)	52	(57.8)	31	(67.4)	43	(58.9)	36	(67.9)
Married	8	(9)	2	(4.7)	15	(16.7)	5	(10.9)	7	(9.6)	4	(7.5)
Separated	5	(5.6)	3	(7)	2	(2.2)	2	(4.3)	3	(4.1)	2	(3.8)
Divorced	8	(9)	9	(20.9)	12	(13.3)	5	(10.9)	5	(6.8)	6	(11.3)
Widowed	0	(0)	0	(0)	1	(1.1)	0	(0)	0	(0)	0	(0)
Living together, but not married	8	(9)	7	(16.3)	8	(8.9)	3	(6.5)	15	(20.5)	5	(9.4)

While data about participants' military service were not available for this dissertation, the project TIP sample is similar to that of the United States armed forces (Department of Defense, 2016; Militaryonesource, 2016). For instance, approximately 80% of this study's sample is male compared to the military which is comprised of approximately 79% males. Furthermore, in regard to race and ethnicity, the sample makeup is predominantly White or Caucasian (62%), with an average age of 29 years old compared to the military which is also predominantly White or Caucasian (65%), with an average age of 28.5 years old. Therefore, this dissertation will serve as a proxy for military members and results from analyses are expected to be relatable to both civilian and military populations.

Measures and Study Variables

SOCIODEMOGRAPHIC FACTORS. The demographic characteristics for this dissertation include age, gender, race/ethnicity, employment status, and marital status.

ANXIETY. Respondents were grouped into either the anxiety (*N*=142) or non-anxiety (*N*=252) groups based on BSI anxiety subscale scores. Previous research has identified a t-score of 62 on the Brief Symptom Inventory (BSI)-18 anxiety subscale as a cutoff for clinically significant anxiety symptomology. The BSI is used to evaluate psychiatric disorders by collecting data directly from patients using either a 53 or 18 item test, and can be used to measure patient progress and psychological distress (Derogatis and Spencer, 1993). The BSI-18 was used in Project TIP to measure three psychological

symptom dimensions (somatization, depression, and anxiety). For the purposes of this dissertation, only items pertaining to the anxiety subscale will be used.

Participants who scored above a 62 on the BSI anxiety subscale were categorized as the anxiety group and those who scored a 62 or below were categorized as the non-anxiety group. However, there may be some room for error among those who score at or near the cutoff point. For instance, is someone with a score of 62 significantly less anxious than someone with a score of 63? In examining this study's sample no individual cutoff score was near the actual cutoff point with the nearest points more than three points away in either direction.

SUBSTANCE USE. In the TIP study, participants were asked about their use of a variety of substances including alcohol, marijuana, and cocaine. For this dissertation, the measure of substance use will be based on percent days abstinent (PDA) in the last 90 days assessed at 3, 6, and 12 months. The number of days a participant endorsed using was divided by 90 to calculate PDA. This dissertation will focus on four substance categories: *any drug*, *alcohol*, *marijuana*, and *cocaine*. The category of *any drug* includes all drugs surveyed in this dissertation (including alcohol, marijuana, and cocaine). The variable percent days abstinent (PDA) was created using participants' responses regarding each substance endorsed, obtained through TimeLine Follow Back (TLFB) procedures (described below).

The TLFB method is an interview technique used to aid subjects in retrospectively measuring specific behaviors, in this case, percent days abstinent from substance use. The common procedure for this technique is to provide the subject with a

calendar and ask him or her to provide retrospective estimates of their daily substance use over a specified period of time up to 12 months. The TLFB can be administered by an interviewer or self-administered and takes between 25 to 30 minutes to complete (Sobell & Sobell, 1992). A study trained staff member administered the TLFB in Project TIP.

TRANSTHEORETICAL MODEL (TTM) INSTRUMENTS. The transtheoretical model consists of various constructs (i.e., *processes of change, self-efficacy, decisional balance, Readiness to Change*), which were measured in Project TIP with the tools listed below.

Process of Change Questionnaire (PCQ). An individual's processes of change were originally assessed using the 40-item PCQ (Petrocelli, 2002; Prochaska et al., 1988). Project TIP used an adapted 33-item PCQ self-report scale that measured 10 experiential and behavioral processes of change on a Likert scale from 1 (never) to 5 (repeatedly). Previous studies have established the PCQ's reliability and validity for various behaviors for drug users, including multidrug use (Belding, Iguchi, Lamb, & Lakin, 1995). Using a sample of cocaine-dependent patients in an outpatient program, Stotts et al. (2001) determined that Cronbach's alpha was .82 for the experiential subscale was .82 and for the behavioral subscale.

Abstinence Self-Efficacy Scale (ASE). This 31-item, self-report ASE measure, which contains four sub-scales (negative affect, social situations, craving and withdrawal, and personal problems), assesses an individual's self-efficacy to abstain from alcohol and/or other drug use, based on Bandura's construct of self-efficacy (DiClemente, Carbonari, Montgomery, & Hughes, 1994). Participants select a rating on a 5-point Likert scale to indicate their confidence to abstain from a substance across different high-risk

situations. Additionally, using a parallel set of items on a 5-point Likert scale, participants indicate temptation to use in each situation. This measure has been utilized in various settings and populations (Kim, Kim, & Gulick, 2009) and has been translated for use internationally, including in Ghana (Glozah, Adu, & Komesuor, 2015), Germany (Zingg et al., 2009), and Korea (Yang et al., 2017). This scale has been found to be high reliability when applied to cocaine, with Cronbach's alphas for the subscale scores ranging from .82 to .88 (Rosenbloom,1991).

Decisional Balance (DB) Scale. According to (Prochaska and Velicer (1997), DB reflects how individuals weigh the pros and cons of changing a behavior. This dissertation employs a 12-item measure to capture how participants rate the importance of changing a behavior through pros and cons for change. Participants rate how important a behavior is to them with scores ranging from 1 to 5 with 1 being the least important. Responses include, "*not at all" "a little bit" "some" "quite a bit"* or *"a lot"*. The DB scale has demonstrated a high level of internal consistency when applied to cocaine with a Cronbach's alpha of .86 for the Pros subscale and .87 for the Cons subscale.

University of Rhode Island Change Assessment (URICA) Scale. The URICA scale is used to measure an individual's attitude toward readiness to change (DiClemente et al, 1991). The measure consists of 32 items designed to represent the four primary stages of change (i.e. precontemplation, contemplation, action, and maintenance). Each subscale, representing each stage of change, contains eight items (Dozois, Westra, Collins, & Garry, 2004). Responses are given on a 5-point Likert scale ranging from 1 (strong disagreement) to 5 (strong agreement). The subscales can be combined

arithmetically to yield a second-order continuous *Readiness to Change* score that can be used to assess readiness to change at entrance to treatment. This scale has demonstrated reliability in multiple samples and among a wide array of studies assessing addiction and substance use disorders (Field, Adinoff, Harris, Ball, & Carroll, 2009). DiClemente and Hughes (1990) reported that Cronbach's alpha ranged from .69 to .82, while in another study, Project MATCH Cronbach's alphas ranged from .68 to .85 (Carbonari & DiClemente, 2000). In the current study the URICA will be used to create a *readiness score* which is derived by adding the subscale means of contemplation, action, and maintenance, and subtracting the subscale mean of precontemplation from that sum.

PRELIMINARY DATA SCREENING

Missing Data

At baseline no missing data were identified. At the 3-month time point, 26 cases were missing. The missing data was assumed to be missing completely at random (MCAR), based on a missing data analysis, Little's MCAR test: Chi-Square = .00, p = 1.00. This was also the case for the 12-month time point where 43 cases were assumed MCAR based on Little's MCAR test: Chi-Square = .00, p = 1.00. However, at the 6-month time point, 27 cases were identified as missing, and these were assumed to be missing at random (MAR): Chi-Square = 26.22, p = 0.00. Given that t-tests at baseline revealed no significant differences of substance use between these 27 participants and the rest of the participants in the study, and as no other time points revealed significant patterns of missing data, there is no reason to believe that the data missing at this timepoint are

different. Therefore, no imputation will be performed, and listwise deletions will be employed for future analysis to eliminate the missing data. All remaining data will be used for further analysis based on the Hair et al.'s (2015) recommendations for identifying missing data and applying remedies.

Outliers and Violations of Normality

Prior to running any analyses, variables were screened for assumptions of normality, outliers, and skewness. Histograms were run on all dependent variables as well as the only continuous independent variable, *age*. This revealed the following: The variable *age*, was judged to be positively skewed, but given the small number of participants in the tail of the histogram, this was not deemed to be significantly problematic. The variables *alcohol* and *cocaine* were negatively skewed and both *cannabis* and *any drug* were bimodal. In each of these cases, transformations were ruled out because they could not adequately address both the bimodal distributions and skew of the variables. After converting variables to Mahalanobis Distance scores and running a descriptive analysis, 4 multivariate outliers were identified. When apparent outliers were eliminated, there was no substantive difference in results from analyses with and without outliers. As there were so few outliers compared to the overall number of participants, 352, and as it is impossible to dispute they do not represent some portion of the larger population, the assumed outliers were retained.

V. RESULTS

To check for potential treatment effects, analyses were run by treatment conditions (brief advice, MI, and MI plus a booster) between anxiety and non-anxiety groups. Analyses did not reveal a treatment effect at any time for any substance between the two groups. Therefore, analyses were collapsed across treatment conditions to include comparisons between anxiety and non-anxiety groups.

Baseline T-tests for Substance Use Outcomes

An independent samples t-test was performed to assess whether average substance use (as measured by percent days abstinent) differed between anxiety and non-anxiety participants at baseline. Substance use categories included *all drugs*, *alcohol*, *marijuana (cannabis)*, and *cocaine* (see Table 5.1). A test of homogeneity revealed a violation between the two groups for the dependent variable *cocaine*. Therefore, the corrected analysis results, where equal variances were not assumed, are presented for *cocaine* with a Levene's F= 28.69, $p < .001$. There were significant differences between the anxiety and non-anxiety groups for three of the four substance use categories: *alcohol*, $t(392)= 2.430$, $p= .016$; *cannabis*, $t(392)= -2.42$, $p= .016$; *cocaine*, $t(174)= 2.831$, $p =.005$. *Any drug* was the only category that did not differ significantly, $t(392)= -1.19$, $p= .235$. An examination of the means between the two groups provides additional insight. In the case of *alcohol* and *cocaine*, the non-anxiety groups showed more days abstinent (PDA), while for *cannabis*, the anxiety group showed fewer days abstinent (see Table 5.2).

Table 5.1

Baseline t-tests comparing anxiety and non-anxiety groups on substance use

		t	*df*	***Sig (2-tailed)***	**95% Conf Inter**	
					lower	***upper***
Alcohol	Equal variances assumed	2.430	392	**.016**	.015	.138
Any Drug	Equal variances assumed	-1.190	392	.235	-.116	.029
Cannabis	Equal variances assumed	-2.419	392	**.016**	-.165	-.017
Cocaine	Equal variances not assumed	2.831	174	**.005**	.009	.050

Note: $p < .05$

Table 5.2

PDA means by anxiety group for all substances at baseline

	Group	**Mean**	**Std. Deviation**
Alcohol	Non-Anxiety	.75	.29
	Anxiety	.67	.31
Any Drug	Non-Anxiety	.45	.36
	Anxiety	.50	.34
Cannabis	Non-Anxiety	.50	.36
	Anxiety	.59	.36
Cocaine	Non-Anxiety	.98	.05
	Anxiety	.96	.12

Repeated Measures for Substance Use Outcomes

Substance use outcomes were examined through General Linear Model (GLM) repeated measures analyses. For these analyses, four separate repeated measures were conducted for each of the four substances, where each substance was examined across the four time points. Interactions were investigated using multivariate tests (see Table 5.3). Of the four substances, only *cocaine* had a significant interaction effect, Wilks' $\lambda = .97$, $p = .006$.

Table 5.3

Interaction between anxiety groups across PDA Substance Use Outcomes over time

	Wilks' λ	*F*	Sig
Alcohol	.99	1.51	.212
Any Drug	1.00	.58	.631
Cannabis	1.00	.25	.859
Cocaine	.97	4.24	**.006**

Note: $p < .05$

There were no interaction effects of *alcohol* across time by *anxiety group, any drug* across time by anxiety group, or *cannabis* across time by anxiety group (see Figures 5.1 through 5.3 and Table 5.3). However, there was a significant interaction effect for *cocaine* across time by *anxiety group* (see Table 5.3 and Figure 5.4). Yet, parameter estimates identified that the two groups only differed at baseline for cocaine. In comparison, those with anxiety reported fewer days abstinent on average than those without anxiety (see Tables 5.4 through 5.7).

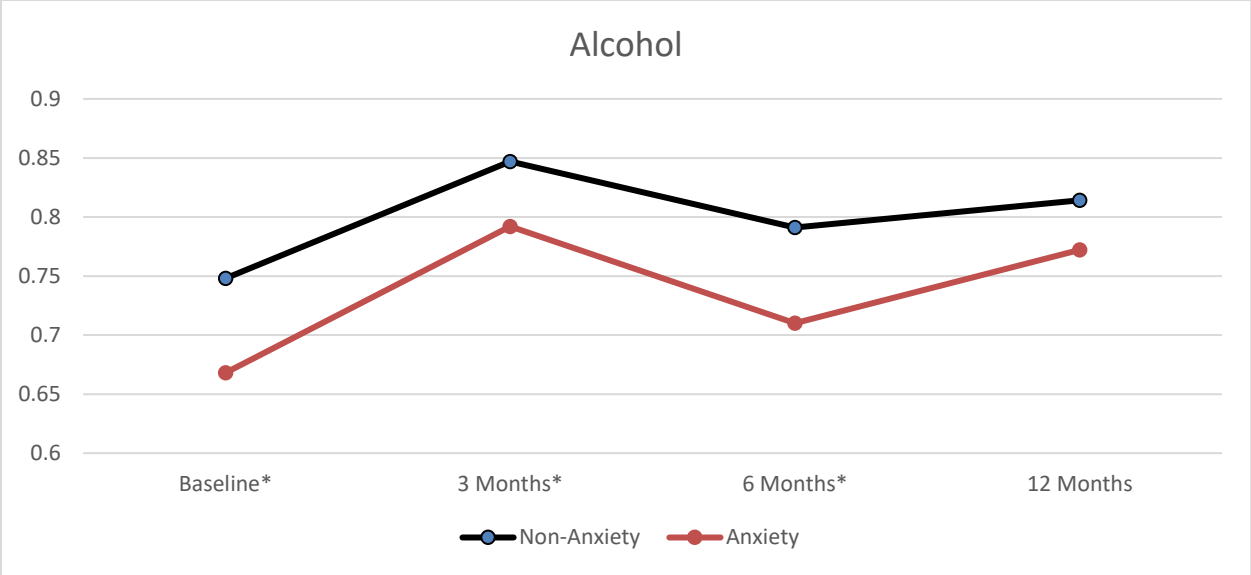

Figure 5.1. PDA for alcohol between anxiety and non-anxiety groups over time. p = * < .05, ** < .01, *** < .001

Table 5.4

Comparison of Anxiety versus Non-anxiety groups on PDA for alcohol: baseline, 3-, 6-, and 12-months

Alcohol	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Baseline	.08 (.03)	2.42	**.016**	.02	.14
3 Months	.06 (.03)	2.05	**.041**	.00	.11
6 Months	.08 (.03)	2.54	**.012**	.02	.14
12 Months	.04 (.03)	1.47	.143	-.01	.10

Note: p < .05

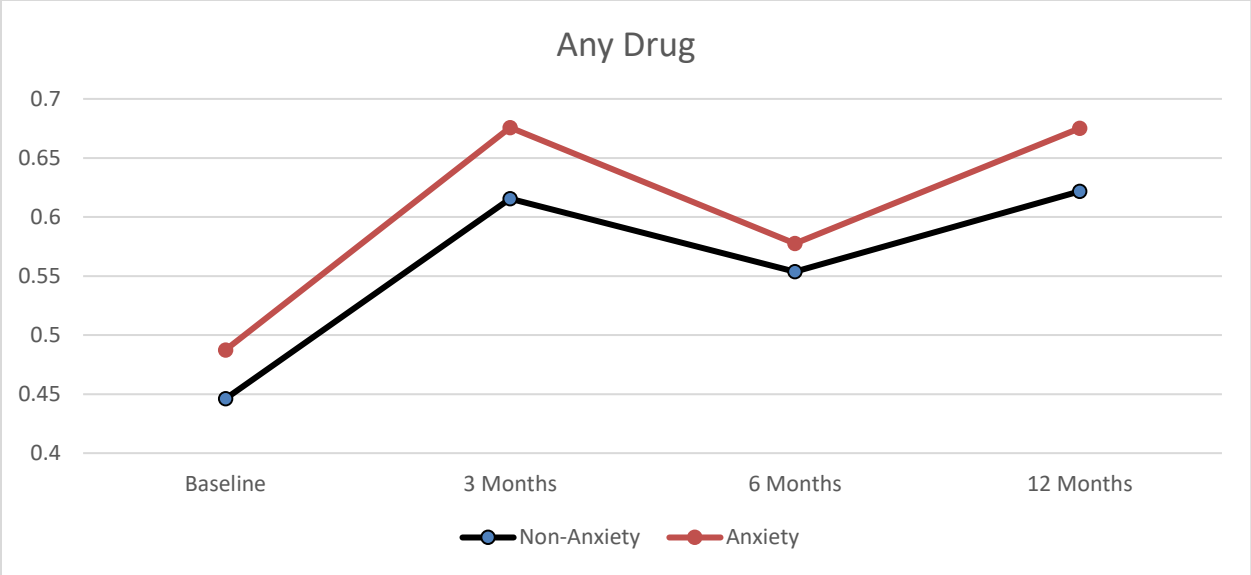

Figure 5.2. PDA for any drug between anxiety and non-anxiety groups over time. p = * < .05, ** < .01, *** < .001

Table 5.5

Comparison of Anxiety versus Non-anxiety groups on PDA for any drug: baseline, 3-, 6-, and 12-months

Any Drug	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Baseline	-.04 (.04)	-1.06	.289	-.12	.04
3 Months	-.06 (.04)	-1.53	.127	-.14	.02
6 Months	-.02 (.04)	-.56	.577	-.11	.06
12 Months	-.05 (.04)	-1.35	.18	-.13	.03

Note: p < .05

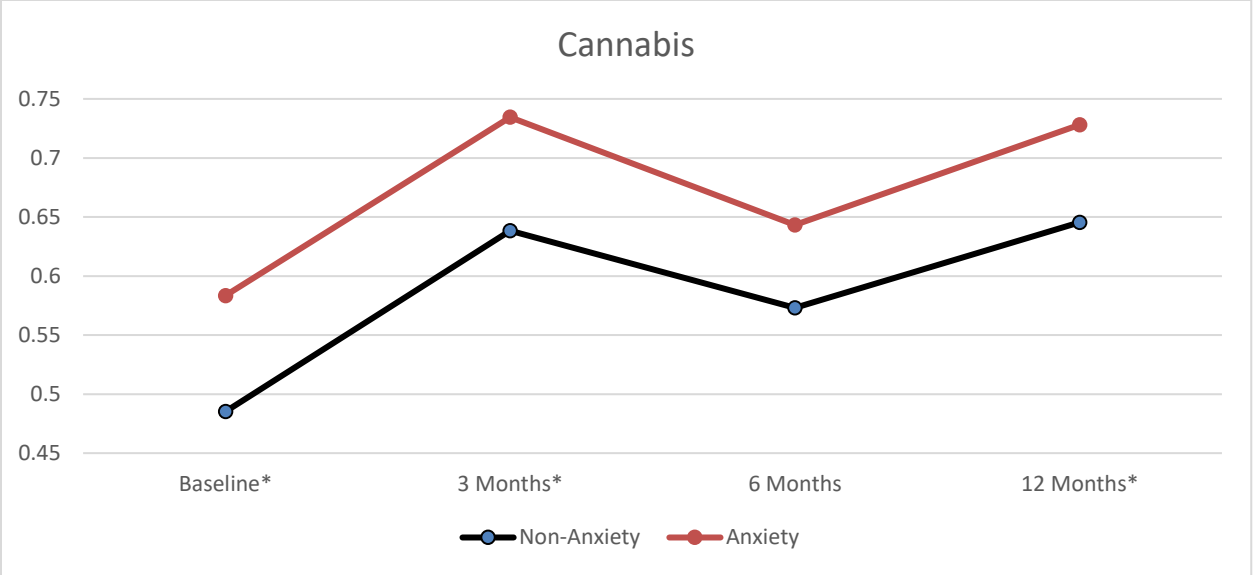

Figure 5.3. PDA for cannabis between anxiety and non-anxiety groups over time. p = * < .05, ** < .01, *** < .001

Table 5.6

Comparison of Anxiety versus Non-anxiety groups on PDA for cannabis: baseline, 3-, 6-, and 12-months

Cannabis	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Baseline	-.10 (.04)	-2.46	**.014**	-.18	-.02
3 Months	-.10 (.04)	-2.55	**.01**	-.17	-.02
6 Months	-.07 (.04)	-1.67	.096	-.15	.01
12 Months	-.08 (.04)	**-2.12**	**.035**	-.16	-.01

Note: p < .05

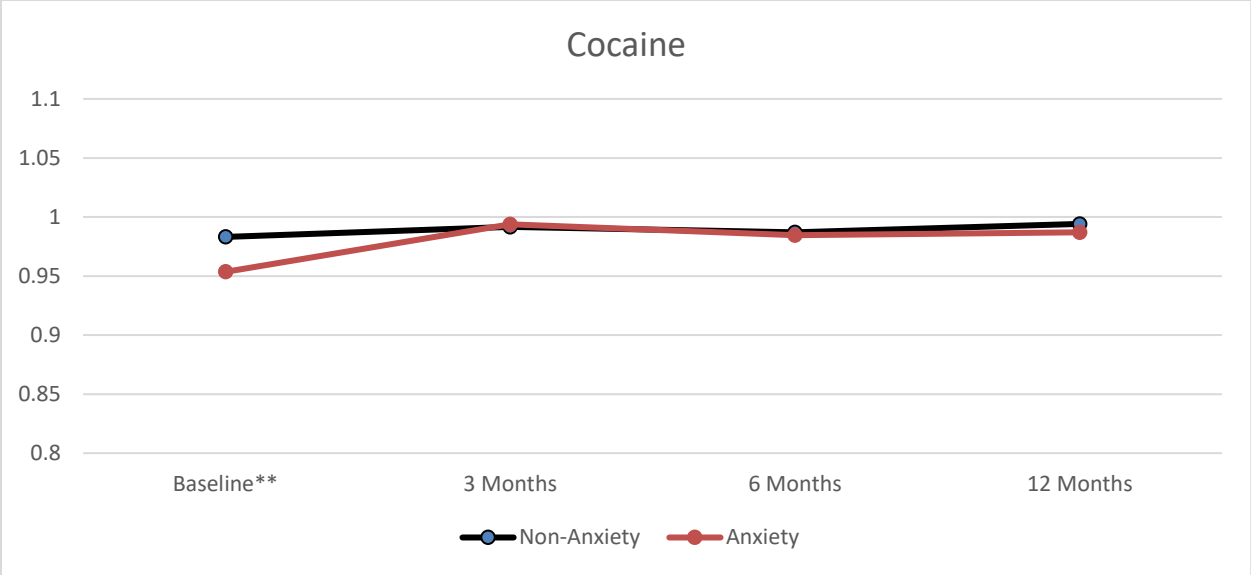

Figure 5.4. PDA for cocaine between anxiety and non-anxiety groups over time. p = * < .05, ** < .01, *** < .001

Table 5.7

Comparison of Anxiety versus Non-anxiety groups on PDA for cocaine: baseline, 3-, 6-, and 12-months

Cocaine	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Baseline	.03 (.01)	3.11	**.002**	.01	.05
3 Months	-.00 (.01)	-39	.698	-.01	.01
6 Months	.00 (.01)	.27	.792	-.02	.02
12 Months	.01 (.01)	1.30	.19	-.00	.02

Note: p < .05

The main effects for anxiety and non-anxiety groups across the four substances show that the two groups differed on *alcohol* and *cannabis* use but not on *any drug* or *cocaine* (see Table 5.8). A comparison of means across time showed that the anxiety group reported significantly fewer PDA for *alcohol* (see Figure 5.1), and greater PDA for *cannabis* (see Figure 5.3), than the non-anxiety group.

Table 5.8

Main Effect for Percent Days Abstinent by Substance

Substance	Type III Sum of Squares *(df)*	*F*	*p*
Alcohol	1.34 (1)	6.16	**.014**
Any Drug	.65 (1)	1.80	.18
Cannabis	2.44 (1)	6.92	**.009**
Cocaine	.03 (1)	2.27	.132

Note: $p < .05$

Multivariate analyses revealed a time effect for each of the four substances analyzed (see Table 5.9). In each case, the greatest improvement in PDA for both anxiety and non-anxiety participants occurred at 3 months. At six months, these improvements seemed to diminish. Finally, at 12 months, both anxiety and non-anxiety groups seemed to rebound with improvement in PDA for all substance use outcomes from baseline to 12 months. In summary, although there were between subject effects for the anxiety and non-anxiety groups and a time effect for PDA, there were no significant differences in change over time by the anxiety or non-anxiety groups.

Table 5.9

Time Effects for Percent Days Abstinent by Substance

	Wilks' λ	*F*	Sig
Alcohol	.78	32.67 (3, 346)	**.000**
Any Drug	.70	48.65 (3, 346)	**.000**
Cannabis	.76	36.68 (3, 346)	**.000**
Cocaine	.91	11.83 (3, 346)	**.000**

Note: $p < .05$

Profile Analyses

Profile Analysis is a special application of multivariate analysis of variance (MANOVA) for repeated measures that can be used when several dependent variables (e.g. subscales of the TTM measures) are measured at one time. This analysis provides various tests of interest, but the only test of interest for this study is the test of parallelism, which is equivalent to the interaction effect in a standard MANOVA and assesses the patterns of the mean values of the dependent variables. Rejection of the null hypothesis of parallelism would suggest a parallelism effect, indicating differences in the overall shape of the profiles (Tabachnick & Fidell, 2012). Profile analyses, comparing the anxiety group to the non-anxiety group were used to examine the process of change using TTM constructs as dependent variables (i.e. decisional balance, self-efficacy, and processes of change, and readiness) at four time points (baseline, 3-, 6-, and 12- months) for both cannabis and cocaine. Because project TIP did not collect TTM construct data for alcohol or any drug use, they could not be included in these analyses.

CANNABIS

Cannabis TTM constructs were compared at all four time points (i.e. URICA *precontemplation, contemplation, action, maintenance*; Decisional Balance, *pros* and *cons for change*; *confidence; temptation*; and Processes of Change, e*xperiential* and *behavioral*). The first three time points there were significant parallelism effects between the anxiety and non-anxiety groups (see Table 5.10).

Table 5.10

TTM Constructs Multivariate Tests for parallelism for Cannabis

	Wilks' λ	***F***	**Sig**
Baseline	.88	4.68 (9, 300)	**.000**
3 months	.91	2.56 (9, 241)	**.008**
6 months	.91	2.56 (9, 246)	**.008**
12 months	.96	1.35 (9, 283)	.212

Note: $p < .05$

Table 5.11 shows that at baseline, all constructs differed significantly between the two groups, with the exception of the precontemplation construct, (p=.162). Of those that were significantly different, the anxiety group reported greater engagement in *contemplation* ($p < .001$), *action* ($p < .001$), *and maintenance* ($p < .001$) than the non-anxiety group. The anxiety group also reported more *pros* ($p = .008$) *and cons for change* ($p < .001$), greater *temptation* ($p < .001$), and greater use of the *experiential* ($p < .001$), and *behavioral* processes of change ($p < .001$). *F*igure 5.5 presents a comparison of mean differences between the anxiety and non-anxiety groups.

Table 5.11

Baseline TTM Construct Parameter Estimates of Between Subjects Effects for Cannabis

Baseline	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	1.66 (1.18)	1.40	.162	-.67	3.98
Contemplation	-6.78 (1.133)	-5.98	**.000**	-9.01	-4.55
Action	-5.15 (1.52)	-4.47	**.000**	-7.41	-2.88
Maintenance	-6.08 (1.128)	-5.39	**.000**	-8.29	-3.86
DB Pro for change	-3.09 (1.16)	-2.67	**.008**	-5.38	-.81
DB Con for change	-4.59 (1.19)	-3.87	**.000**	-6.92	-2.26
Confidence	3.20 (1.17)	2.73	**.007**	.90	5.50
Temptation	-4.32 (1.17)	-3.68	**.000**	-6.63	-2.01
Experiential	-4.59 (1.16)	-3.95	**.000**	-6.87	-2.30
Behavioral	-4.35 (1.15)	-3.78	**.000**	-6.61	-2.08

Note: $p < .05$

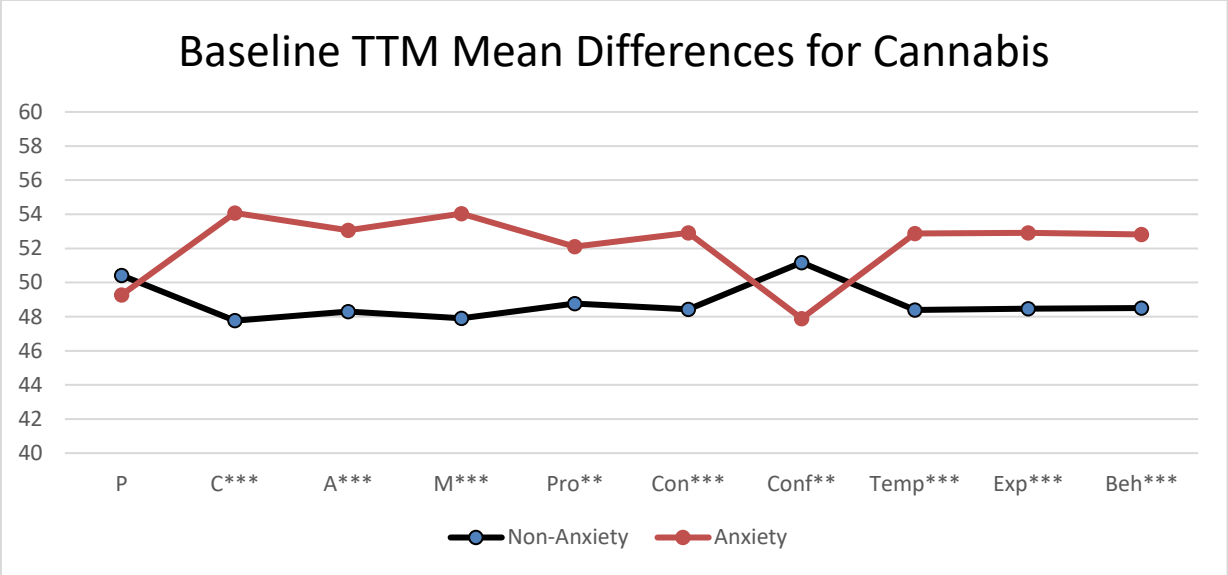

Figure 5.5. Baseline mean differences in TTM constructs between anxiety and non-anxiety groups for cannabis. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

Table 5.12 and Figure 5.6 show that the only change from baseline to the 3-month time point, was in the *confidence* construct, which became non-significant (p=.182). The anxiety group continued to engage more in *contemplation* ($p < .001$), *action* ($p < .001$), *and maintenance* ($p < .001$), than the non-anxiety group and reported more *pros* ($p = .013$) *and cons for change* ($p = .017$), greater *temptation* ($p = .030$), as well as greater use of the *experiential* ($p < .001$), and *behavioral* processes of change ($p < .001$).

Table 5.12

3 Month TTM Construct Parameter Estimates of Between Subjects Effects for Cannabis

3 Months	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	.67 (1.34)	.50	.616	-1.96	3.30
Contemplation	-6.12 (1.26)	-4.85	**.000**	-8.62	-3.64
Action	-5.10 (1.27)	-4.01	**.000**	-7.61	-2.60
Maintenance	-5.95 (1.27)	-4.69	**.000**	-8.45	-3.45
DB Pro for change	-3.31 (1.32)	-2.51	**.013**	-5.90	-.71
DB Con for change	-3.12 (1.30)	-2.40	**.017**	-5.69	-.55
Confidence	1.74 (1.30)	1.34	.182	-.82	4.31
Temptation	-2.86 (1.31)	-2.19	**.030**	-5.43	-.29
Experiential	-4.70 (1.31)	-3.59	**.000**	-7.27	-2.11
Behavioral	-4.71 (1.30)	-3.63	**.000**	-7.27	-2.15

Note: $p < .05$

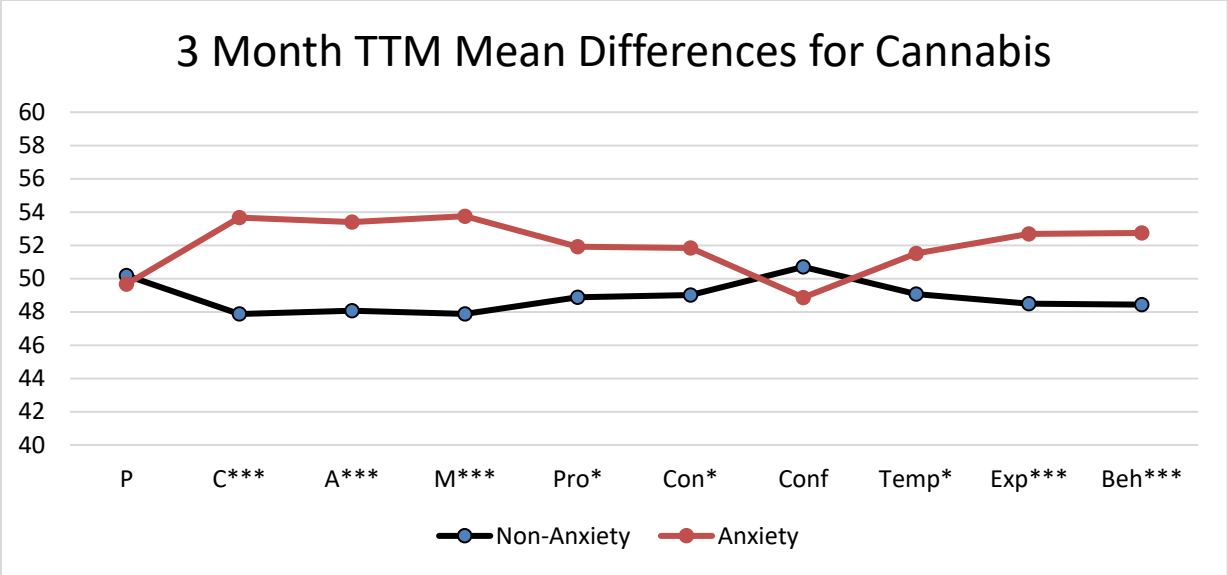

Figure 5.6. 3-month mean differences in TTM constructs between anxiety and non-anxiety groups for cannabis. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

Table 5.13 and Figure 5.7 show that no further significant changes in use of constructs at the 6-month assessment between the two groups. Again, the anxiety group engaged more in *contemplation* ($p < .001$), *action* ($p = .001$), *and maintenance* ($p < .001$) than the non-anxiety group. The anxiety group also reported more *pros* ($p = .002$) *and cons for change* ($p = .007$), greater *temptation* ($p = .019$), and greater use of the *experiential* ($p < .001$), and *behavioral* processes of change ($p < .001$).

Table 5.13

6 Month TTM Construct Parameter Estimates of Between Subjects Effects for Cannabis

6 Months	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	.115 (1.35)	.09	.932	-2.55	2.78
Contemplation	-4.92 (1.12)	-3.73	**.000**	-7.51	-2.32
Action	-4.33 (1.33)	-3.26	**.001**	-6.94	-1.72
Maintenance	-5.86 (1.30)	-4.52	**.000**	-8.42	-3.31
DB Pro for change	-4.67 (1.31)	-3.19	**.002**	-6.74	-1.60
DB Con for change	-3.62 (1.34)	-2.71	**.007**	-6.25	-.99
Confidence	1.87 (1.32)	1.42	.16	-.72	4.47
Temptation	-3.16 (1.34)	-2.36	**.019**	-5.80	-.52
Experiential	-4.99 (1.33)	-3.75	**.000**	-7.60	-2.37
Behavioral	5.21 (1.31)	-3.98	**.000**	-7.79	-2.63

Note: $p < .05$

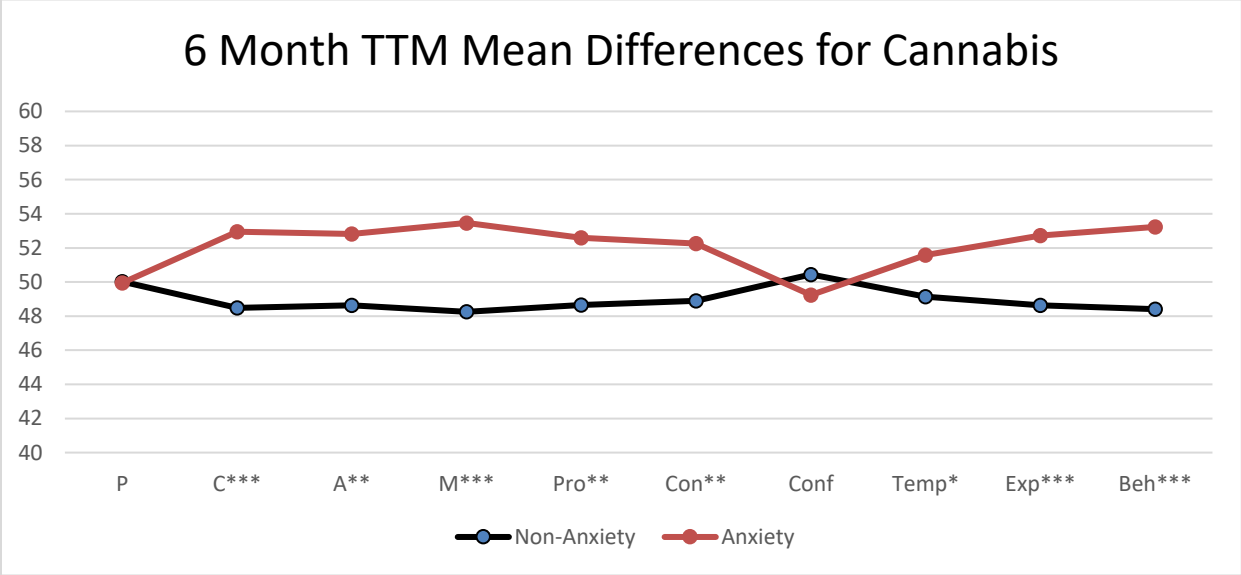

Figure 5.7. 6-month mean differences in TTM constructs between anxiety and non-anxiety groups for cannabis. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

Table 5.14 and figure 5.8 show that at 12-months there was no longer an overall parallelism effect between the anxiety non-anxiety groups. However, an examination of the constructs individually revealed that four of the ten constructs remained significant (see Table 5.14 and Figure 5.8). Of these, the anxiety group reported greater engagement in the *contemplation* construct (p=.045), greater temptation (p=.05), and greater use of the *experiential* (p = .01), and *behavioral* processes of change (p=.008).

Table 5.14

12 Month TTM Construct Parameter Estimates of Between Subjects Effects for Cannabis

12 Months	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	.82 (1.23)	.67	.506	-1.60	3.23
Contemplation	-2.46 (1.22)	-2.02	**.045**	-4.87	-.061
Action	-1.83 (1.23)	-1.48	.14	-4.25	.60
Maintenance	-2.28 (1.23)	-1.86	.064	-4.70	.137
DB Pro for change	-1.66 (1.23)	-1.36	.18	-4.08	.75
DB Con for change	-1.36 (1.23)	-1.11	.27	-3.78	1.06
Confidence	1.06 (1.23	.86	.39	-1.37	3.48
Temptation	-2.39 (1.23)	-1.94	**.05**	-4.82	.04
Experiential	-3.14 (1.25)	-2.52	**.01**	-5.59	-.69
Behavioral	-3.29 (1.24)	-2.66	**.008**	-5.73	-.86

Note: $p < .05$

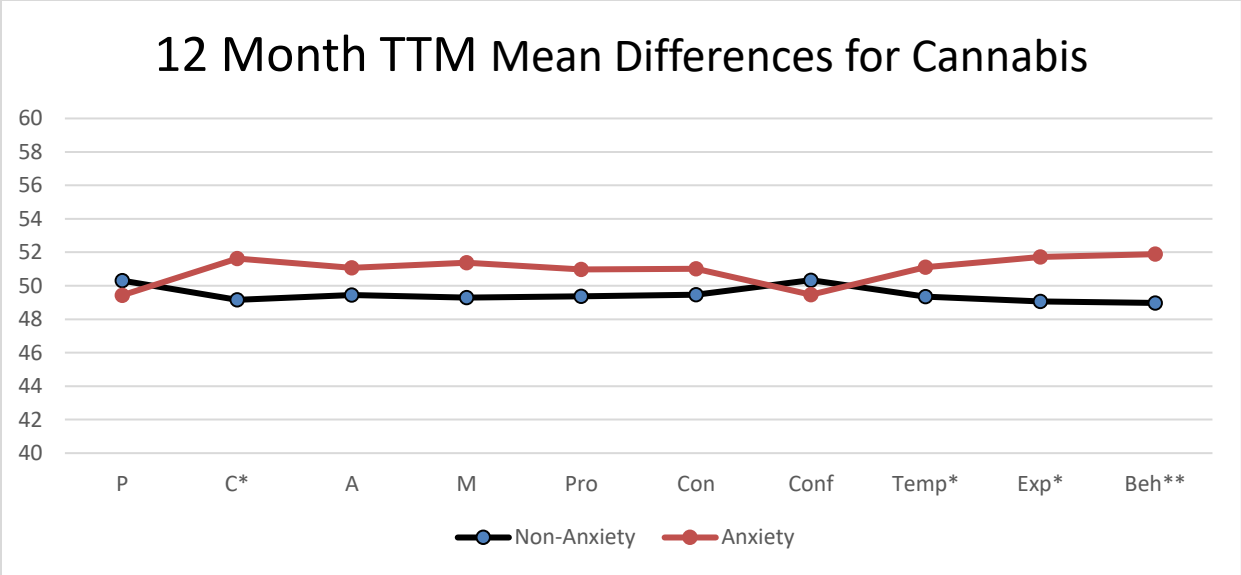

Figure 5.8. 12-month mean differences in TTM constructs between anxiety and non-anxiety groups for cannabis. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

Cocaine

TTM constructs (i.e. Readiness precontemplation, contemplation, action, maintenance; *Decisional Balance pros* and *cons of change; Self-Efficacy confidence and temptation;* and *Processes of Change experiential* and *behavioral*). were also compared for cocaine at all four time points, but only baseline showed parallelism effect between the anxiety and non-anxiety groups (see Table 5.15). Parameter estimates for all time points are listed in Tables 5.15 through 5.18 and Figures 5.9 through 5.12 for review.

Table 5.15

TTM Constructs Multivariate Tests of Parallelism for Cocaine

	Wilks' λ	*F*	Sig
Baseline	.72	3.32 (9, 76)	**.002**
3 months	.81	1.32 (9, 52)	.251
6 months	.81	1.61 (9, 61)	.132
12 months	.85	1.33 (9, 69)	.240

Note: $p < .05$

BASELINE . Table 5.16 and Figure 5.9 show that nearly all of the constructs for cocaine were statistically significant between the two groups at baseline, except for *precontemplation*, (p=.062), and the p*ros for change* (p=.342). Of those that were significantly different, the anxiety group reported greater engagement in *contemplation* (p = .006), *action* (p = .006), *and maintenance* (p = .016). The anxiety group also reported more *cons for change* (p = .001), greater *temptation* (p = .014), and greater use of the *experiential* (p < .001), and *behavioral* processes of change (p = .008) than the non-anxiety group.

Table 5.16

Baseline TTM Construct Parameter Estimates of Between Subjects Effects for Cocaine

Baseline	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	4.11 (2.18)	1.89	.062	-.22	8.44
Contemplation	-5.83 (2.08)	-2.81	**.006**	-9.96	-1.70
Action	-6.34 (2.08)	-3.05	**.003**	-10.46	-2.21
Maintenance	-5.207 (2.12)	-2.46	**.016**	-9.41	-1.00
DB Pro for change	-2.10 (2.20)	-.96	.342	-6.47	2.27
DB Con for change	-7.32 (2.06)	-3.56	**.001**	-11.41	-3.22
Confidence	4.56 (2.160)	2.11	**.038**	.27	8.86
Temptation	-5.40 (2.14)	-2.52	**.014**	-9.66	-1.15
Experiential	-9.43 (1.95)	-4.83	**.000**	-13.31	-5.56
Behavioral	-5.80 (2.13)	-2.73	**.008**	-10.03	-1.57

Note: $p < .05$

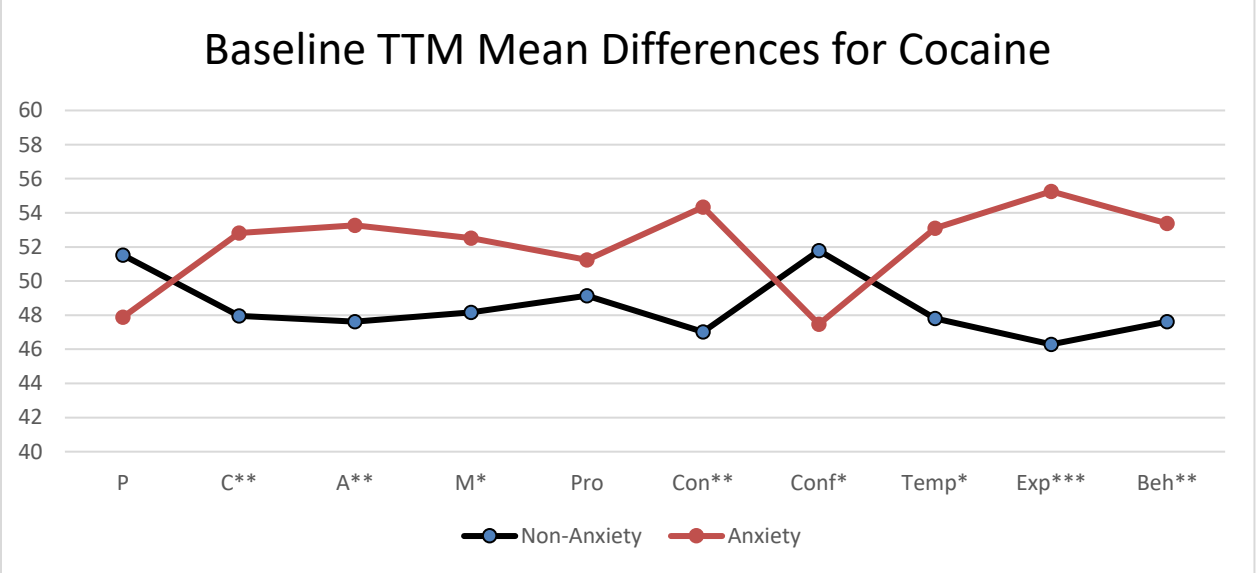

Figure 5.9. Mean differences in TTM constructs between anxiety and non-anxiety groups at baseline for cocaine. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

3-MONTHS. At the 3- month time point, only two constructs remained significant (see Table 5.17 and Figure 5.10). The anxiety group reported greater engagement *contemplation* (p = .014), and greater use of the *experiential* processes of change (p = .046).

Table 5.17

3 Month TTM Construct Parameter Estimates of Between Subjects Effects for Cocaine

3 Months	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	-.54 (2.56)	-.21	.835	-5.66	4.59
Contemplation	-2.53 (2.48)	-2.53	**.014**	-11.25	-1.31
Action	-1.41 (2.53)	-1.41	.165	-8.63	1.51
Maintenance	-3.54 (2.60)	-1.36	.178	-8.72	1.65
DB Pro for change	-2.93 (2.59)	-1.13	.261	-8.11	2.24
DB Con for change	-3.43 (2.52)	-1.36	.179	-8.47	1.61
Confidence	2.66 (2.59)	1.03	.308	-2.52	7.85
Temptation	-2.57 (2.63)	-0.98	.331	-7.832	2.68
Experiential	-5.02 (2.47)	-2.04	**.046**	-9.95	-0.09
Behavioral	-3.52 (2.57)	-1.37	.176	-8.67	1.62

Note: $p < .05$

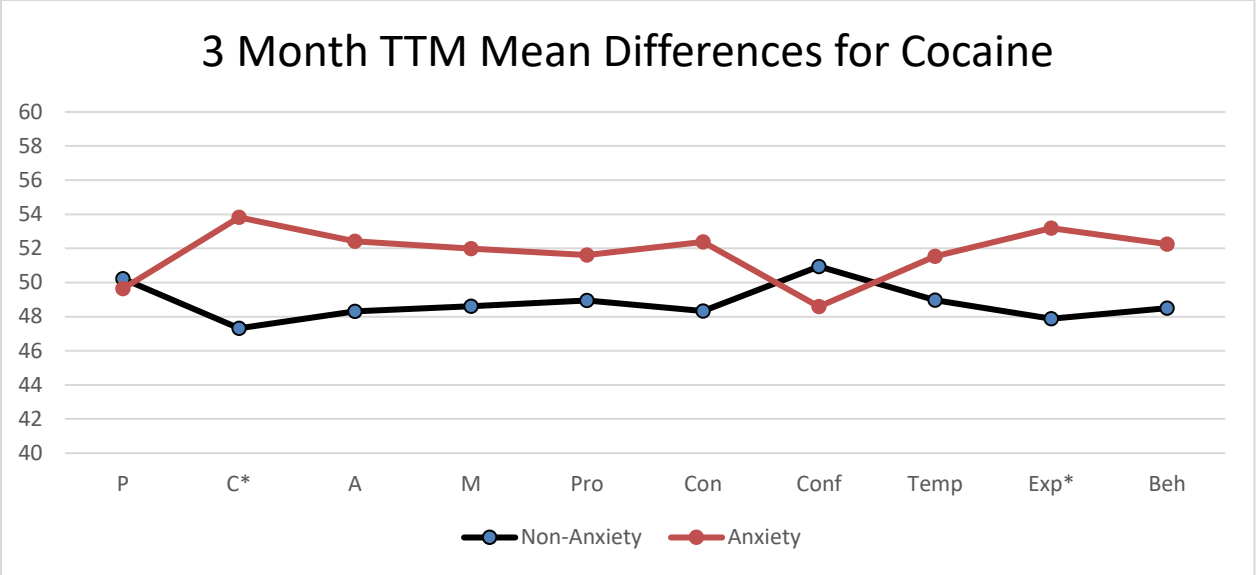

Figure 5.10. Mean differences in TTM constructs between anxiety and non-anxiety groups at 3 months for cocaine. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

6-MONTHS. In 6-month time point, the *contemplation* construct was no longer significant between anxiety and non-anxiety groups (see Table 5.18 and Figure 5.11). However, two other constructs were significant. The anxiety group reported greater use of *experiential* (p = .001) and *behavioral* (p = .018) processes of change.

Table 5.18

6 Month TTM Construct Parameter Estimates of Between Subjects Effects for Cocaine

6 Months	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	-.22 (2.44)	-.90	.929	-5.09	4.65
Contemplation	-3.37 (2.43)	-1.40	.167	-8.23	1.45
Action	-1.22 (2.48)	-0.49	.623	-6.16	3.72
Maintenance	-1.85 (2.45)	-0.75	.454	-6.74	3.05
DB Pro for change	-.58 (2.46)	-0.24	.815	-5.48	4.32
DB Con for change	-4.42 (2.36)	-1.87	.066	-9.14	0.29
Confidence	.24 (2.38)	.10	.921	-4.51	4.99
Temptation	-4.03 (2.40)	-1.68	.097	-8.81	0.75
Experiential	-7.58 (2.26)	-3.36	**.001**	-12.08	-3.08
Behavioral	-5.61 (2.32)	-2.41	**.018**	-10.24	-0.97

Note: $p < .05$

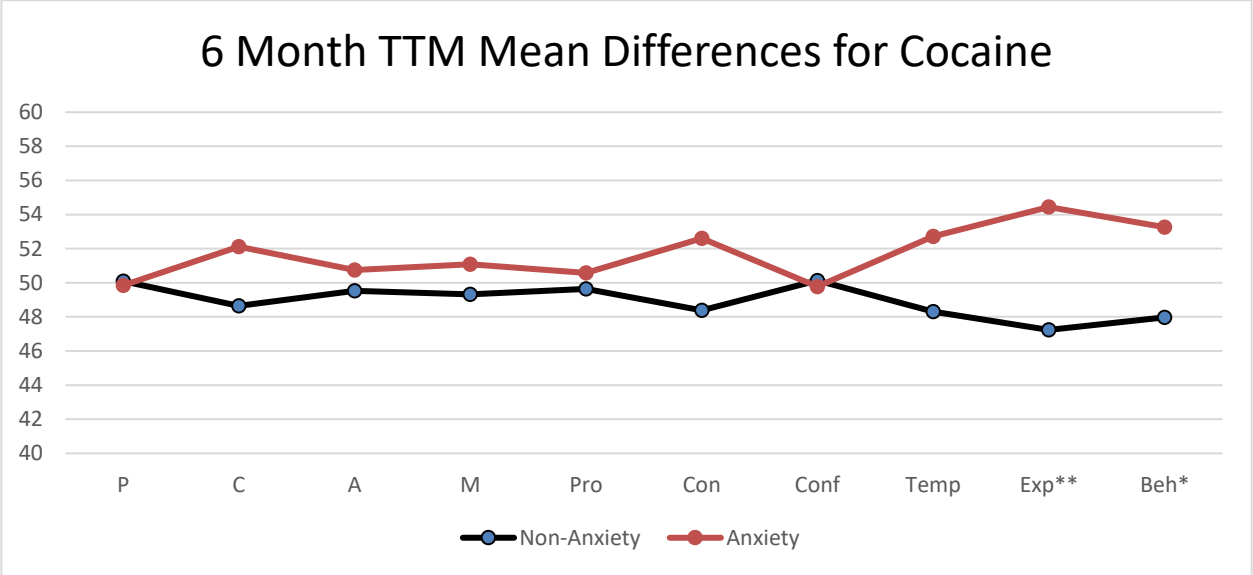

Figure 5.11. Mean differences in TTM constructs between anxiety and non-anxiety groups at 6 months for cocaine. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

12-MONTHS. The final time point revealed three significantly different constructs between the anxiety and non-anxiety groups (see Table 5.19 and Figure 5.12) with the anxiety group reported greater engagement in *maintenance* (p = .024), less *cons for change* (p = .047), and greater use of the *experiential* (p = .011), and *behavioral* processes of change (p = .048).

Table 5.19

12 Month TTM Construct Parameter Estimates of Between Subjects Effects for Cocaine

12 Months	*b* (*SE*)	*t*	*p*	Lower CI	Upper CI
Pre-contemplation	1.51 (2.28)	.66	.511	-3.03	6.05
Contemplation	-3.60 (2.25)	-1.60	.114	-8.08	.88
Action	-3.87 (2.24)	-1.72	.089	-8.34	.60
Maintenance	-5.10 (2.21)	-2.31	**.024**	-9.51	-.70
DB Pro for change	.50 (2.29)	.22	.826	-4.05	5.06
DB Con for change	-4.51 (2.23)	-2.02	**.047**	-8.94	-.07
Confidence	2.40 (2.27)	1.06	.293	-2.12	6.93
Temptation	-3.26 (2.26)	-1.44	.153	-7.75	1.24
Experiential	-5.71 (2.19)	-2.60	**.011**	-10.07	-1.34
Behavioral	-4.48 (2.23)	-2.01	**.048**	-8.92	-.04

Note: $p < .05$

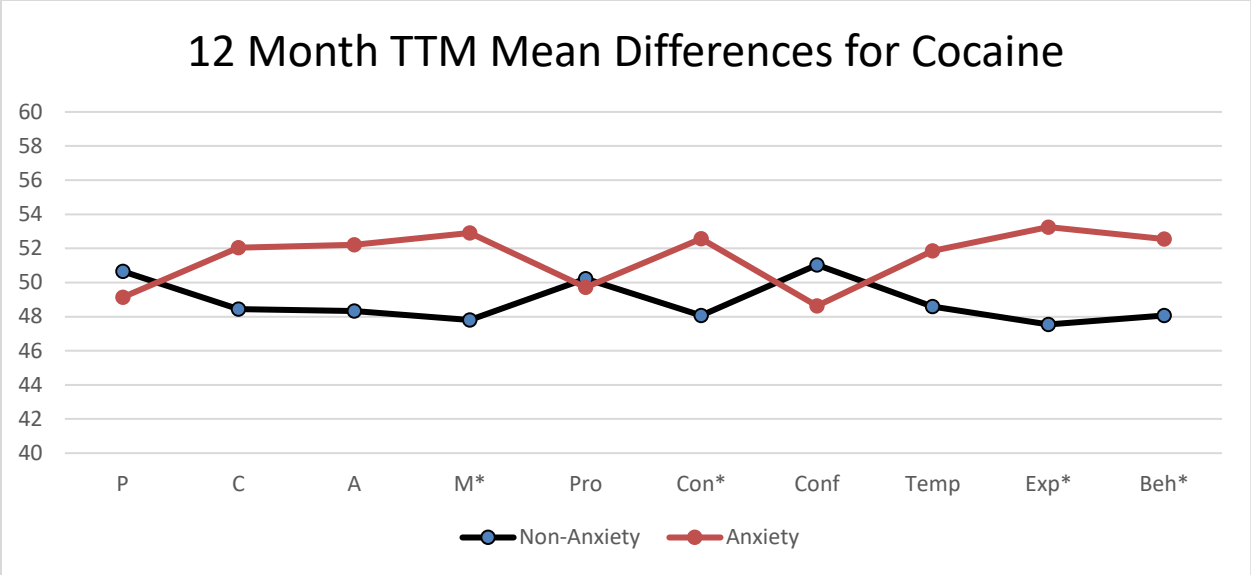

Figure 5.12. Mean differences in TTM constructs between anxiety and non-anxiety groups at 12 months for cocaine. P=Pre-contemplation, C=contemplation, A=Action, M=Maintenance, Pro=DB Pro for Change, Con=DB Con for Change, Conf=Confidence, Temp=Temptation, Exp=Experiential, Beh=Behavioral. p = * < .05, ** < .01, *** < .001

Latent Growth Curve (LGC) Analyses

Baseline models for all TTM constructs were examined using listwise deletion methods, ensuring no missing data were included in analyses. TTM constructs were matched in pairs according to their theoretical contributions to each other: decisional balance *pros* and *cons* for change; *confidence* and *temptation*; and *experiential* and *behavioral* processes of change. The URICA construct for *readiness* ([Contemplation + Action + Maintenance] – Precontemplation) was isolated as the sole construct in its model. Initially each pair of TTM constructs were diagramed. This model represents the conceptual model. Modifications were made to the conceptual model and are presented as the Level 1 model. Finally, the category of *anxiety* was added to the model and is presented as the Level 2 model.

Re-specifications from the conceptual model were made based on AMOS output of model fit using Comparative Fit Index (CFI), Root Mean Square of Approximation (RMSEA), chi square and adjusted chi square values. When model fit was not achieved, modification indices were examined, and models were altered based on the most influential change suggestions through the SEM output. Error terms (labeled ED1 through ED 4 and ER1 through ER4) were covaried only on similar time points. For example, for *confidence* and *temptation*, modification indices suggested covarying the error terms of ED3 and ER3. These each represent error terms for time point three (6 months) for their respective construct (i.e., ED3 = 6 months for the *confidence* construct). When modification indices suggested covarying non-similar time points (e.g., ED1 and ED3), the model was not altered. The labels of ER and ED have no real meaning other

than to signify error terms for each construct (e.g., ED for confidence and ER for temptation).

Following completions of model modifications from the conceptual model (see Tables 5.20 through 5.27 for model modification details for both cannabis and cocaine), the new (re-specified) model represents the Level 1 model and was tested using the full data set with Maximum Likelihood estimation of missing values (see Figures 5.13 through 5.34). The final model was then run with the anxiety variable comparing the two groups and represents the Level 2 model. As noted, this analysis requires the use of modifications indices to identify suggested model alterations. However, the software requires that there be no missing data in order to provide modification indices. Therefore, initial models used only partial data (no missing data) in order to obtain modification indices and make model alterations. Once the conceptual model modifications were complete, the Level 1 and Level 2 models were run with the complete data set. Results of these analyses are first described for *cannabis* (see Table 5.24 for a summary of cannabis findings) followed by the results for *cocaine* (see Table 5.29 for a summary of cocaine findings).

Cannabis Confidence and Temptation

CONCEPTUAL MODEL

The conceptual model of confidence and temptation for cannabis (see Figure 5.13) was first run with the complete data set and did not achieve sufficient model fit (see Table 5.20). Modification indices suggested covarying the *confidence* intercept (Conf_ICEPT) to the *temptation* intercept (Temp_ICEPT) as well as the *confidence* slope

(Conf_SLOPE) to the *temptation* slope (Temp_SLOPE). However, model fit was still not achieved, and modification indices further suggested covarying time points 1 (ED1 to ER1), 2 (ED2 to ER2), and 3 (ED3 to ER3), between the constructs. Covariances were then examined, showing that the paths form *confidence* intercept (Conf_ICEPT) to *confidence* slope (Conf_SLOPE) as well as *temptation* intercept (Temp_ICEPT) to *temptation* slope (Temp_SLOPE) were not significant. The non-significance of these paths indicates that participants' rate of change over time in confidence or temptation was not significantly affected by where they started on either construct. Therefore, these paths were removed for the Level 1 model (see Figure 5.14).

Table 5.20

LGC Cannabis Self-Efficacy TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**Conf & Temp**					
1	**Base Model (Run with no missing data)**	1	382.4	26	.688	.242
	Covaried: Conf ICEPT and Temp ICEPT; Conf SLOPE and Temp Slope; ED3 and ER3; ED2 and ER2; ED1 & ER1 **Eliminated:** Conf ICEPT and Conf SLOPE; Temp ICEPT and Temp SLOPE	2	69.0	23	.960	.092
	Complete Data Model (Run with missing data)	3	67.2	23	.965	.070
2	**Anxiety Model**	4	77.8	27	.967	.063

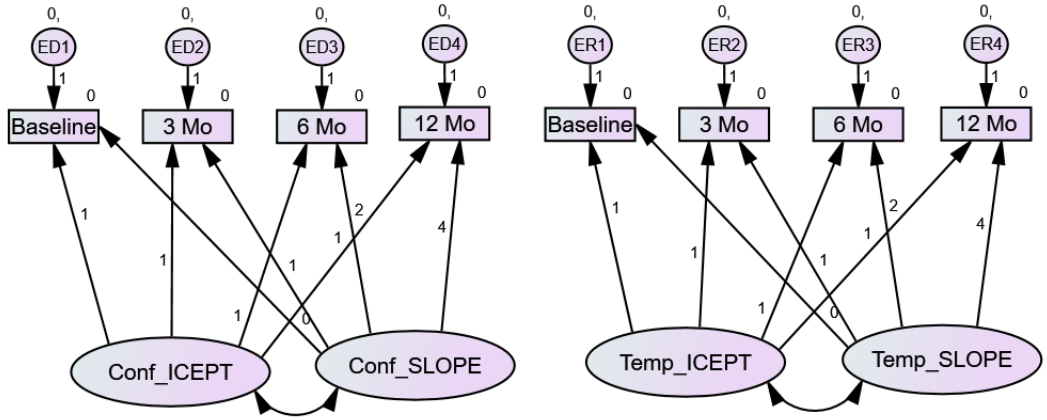

Figure 5.13. Conceptual model of confidence and temptation for cannabis

LEVEL 1.

Means were examined in the Level 1 model and were significant for both *confidence* and *temptations* intercepts and slopes. Specifically, participants initially reported higher levels of confidence (Estimate: 3.06, $p < .001$) than temptation (Estimate: 2.59, $p < .001$) and over time, participants reported significant increases in confidence (Estimate: .05, $p = .006$) and significant decreases in temptation (Estimate: -.06, $p < .001$).

When covariances were re-examined in the Level 1 model, the intercept for *confidence* was negatively related to the intercept for *temptation* (Estimate: -.496, $p <$ .001). This indicates that at baseline participants with higher levels of confidencealso had lower levels of temptation. Additionally, the slope for confidence was negatively related to the slope for *temptation* (Estimate: -.03, $p < .001$), indicating that as participants' confidence increased, their temptation levels decreased.

An examination of variances showed significant intercepts for both *confidence* (Estimate: .59, $p < .001$) and *temptation* (Estimate: .66, $p < .001$) as well as the slopes for both *confidence* (Estimate: .05, $p < .001$) and *temptation* (Estimate: .03, $p < .001$). This indicates that there was significant variation between participants at the starting points for both *confidence* and *temptations*; and that participants differed significantly in their rate of change for both *confidence* and *temptation* over time. This variation is further explored using a predictor variable by dividing participants into anxiety and non-anxiety groups in the level 2 model below.

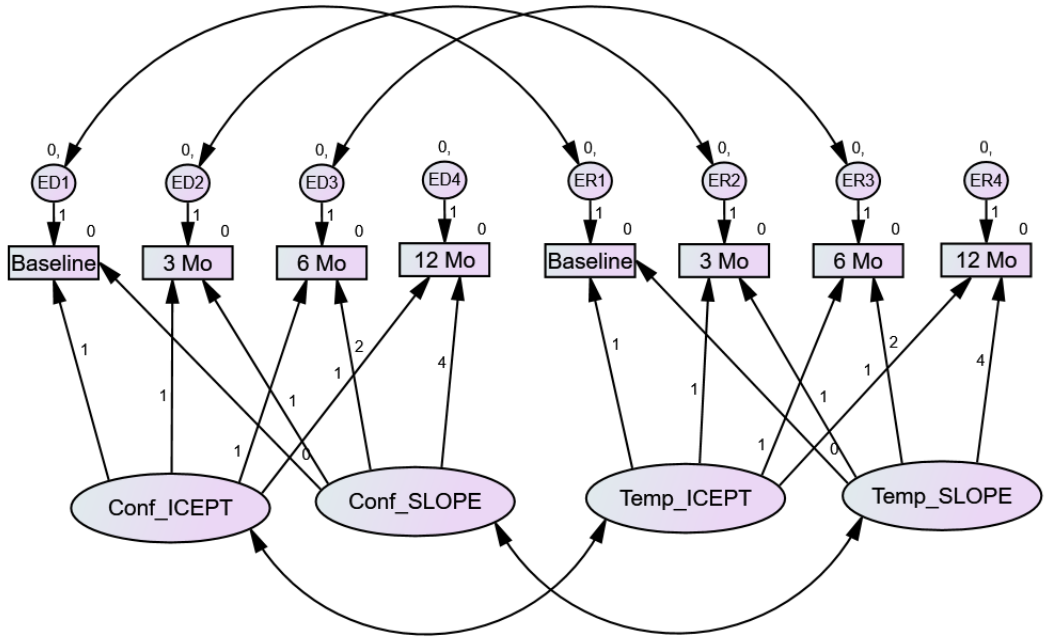

Figure 5.14. Level 1 model of confidence and temptation for cannabis

LEVEL 2.

The level 2 model (see Figure 515) incorporates the predictor variable of anxiety and regression weights were examined. In this model, both the paths from the anxiety variable to the intercepts for *confidence* (Estimate: -.31 p = .006) and *temptation* (Estimate: .41 p < .001) were significant, meaning the anxiety group initially reported lower levels of *confidence*, and higher levels of *temptation* than the non-anxiety group. However, neither of the paths from the anxiety variable to the slopes for *confidence* nor

temptation were significant, indicating that the anxiety groups did not differ significantly in rate of change for either construct over time.

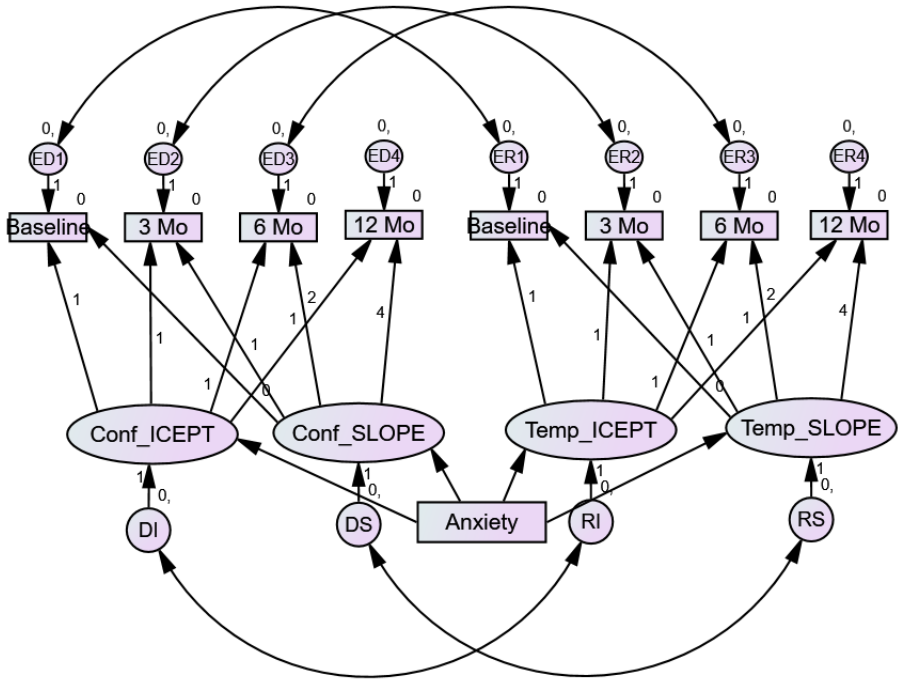

Figure 5.15. Level 2 model of confidence and temptation for cannabis

Cannabis Decisional Balance

CONCEPTUAL MODEL.

The DB conceptual model for cannabis (see Figure 5.16) was first run with the complete data set and did not achieve sufficient model fit (see Table 5.21). Modification indices suggested covarying the pros for change intercept (DBPro_ICEPT) to the cons for change intercept (DBCons_ICEPT) as well as the *pros for change* slope

(DBPro_SLOPE) to the *cons for change* slope (DBCons_SLOPE). However, model fit was still not achieved, and modification indices further suggested covarying time points 1 (ED1 to ER1), 2 (ED2 to ER2), and 3 (ED3 to ER3), between the constructs.

Covariances were then examined, showing that the paths from the *pros for change* intercept (DBPros_ICEPT) to *pros for change slope* (DBPros_SLOPE), as well as *cons for change* intercept (DBCons_ICEPT) to *cons for change* slope (DBCons_SLOPE) were not significant. The non-significance of these paths indicates that participants' rate of change over time in their perceived importance of *pros* or *cons for change* was not significantly affected by where they started on either construct. Therefore, these paths were removed.

Table 5.21

LGC Cannabis DB TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**DB**					
1	**Base Model (Run with no missing data)**	1	183.4	26	.737	.166
	Covaried: Conf ICEPT and Temp ICEPT; Conf SLOPE and Temp Slope; ED3 and ER3; ED2 and ER2; ED1 & ER1	2	35.1	23	.981	.049
	Eliminated: Conf ICEPT and Conf SLOPE; Temp ICEPT and Temp SLOPE					
	Complete Data Model (Run with missing data)	3	43.9	23	.972	.048
2	**Anxiety Model**	4	45.7	27	.975	.042

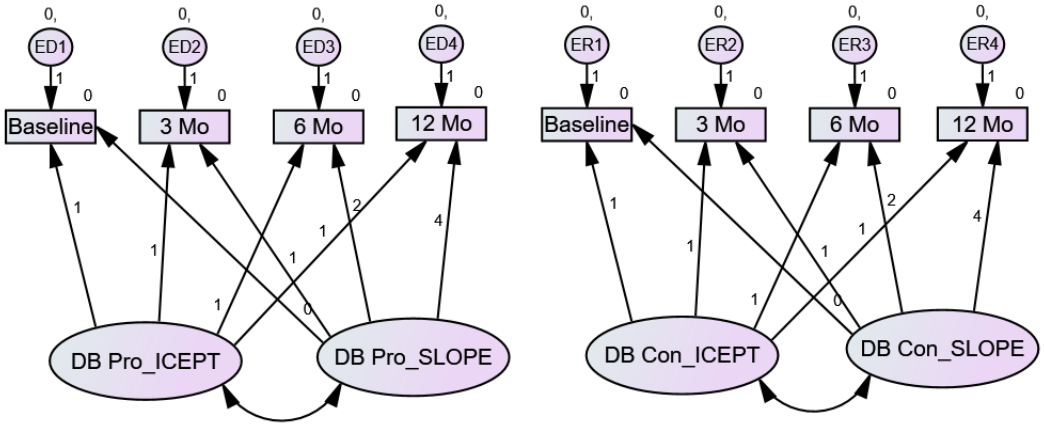

Figure 5.16. Conceptual model of Decisional Balance for cannabis

LEVEL 1.

Means from the Level 1 model for pros and cons for change for cannabis (see Figure 5.17) were examined and showed that both the intercepts for *pros* and *cons for change* were significant and that participants initially reported greater *pros for change* (Estimate: 2.11, $p < .001$), than *cons for change* (Estimate: 1.65, $p < .001$). Additionally, the slope for *pros for change* was significant (Estimate: -.08, $p < .001$), meaning participants reported significant decreases in *pros for change* over time. Covariances from this model showed that the intercept for *pros for change* was positively related to

the intercept for *cons for change* (Estimate: .16, $p < .001$). This indicates that participants who rated higher perceived importance in *pros for change* also rated higher perceived importance in *cons for change*. Additionally, the slope for *pros for change* was positively related to the slope for *cons for change* (Estimate: .01, $p < .001$). An examination of mean scores over time indicated that participants reported a decrease in perceived importance of *pros* and *cons for change* over time, meaning that as participants perceived importance of *pros for change* decreased, there was a similar rate of decrease in their perceived importance of *cons for change*.

Variances in the intercepts for both *pros for change* (Estimate: .44, $p < .001$) and *cons for change* (Estimate: .27, $p < .001$) were significant. This indicates that there was significant variation between participants at the starting points for both *pros* and *cons for change*. Additionally, the slope for *cons for change* (Estimate: .03, $p < .001$) was significant, meaning that participants rate of change for perceived importance of *cons for change* over time differed significantly. This variation was further explored using a predictor variable by dividing participants into anxiety and non-anxiety groups in the level 2 model below.

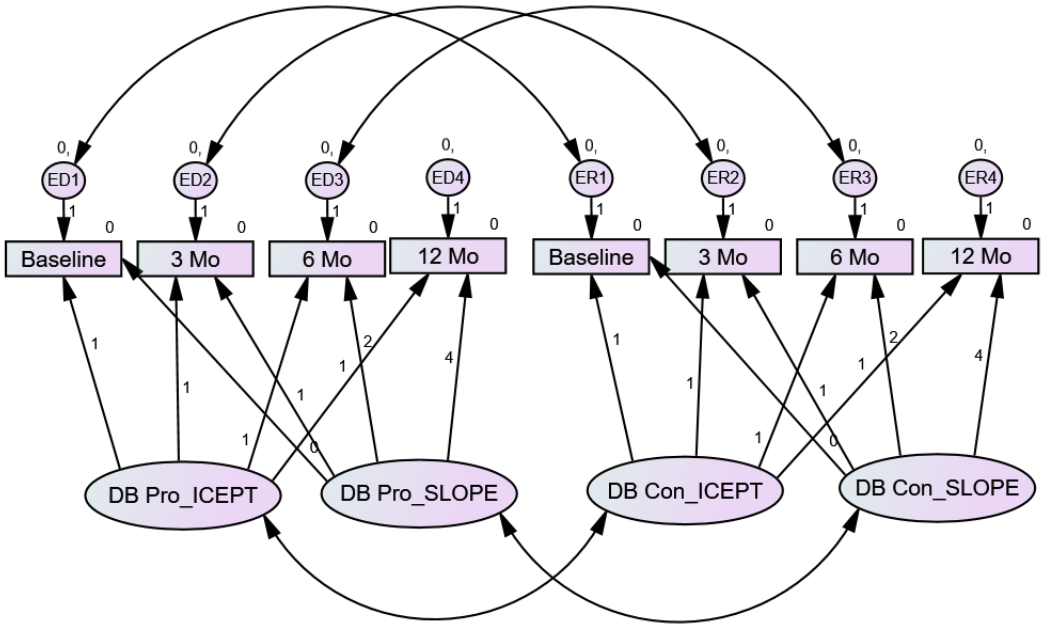

Figure 5.17. Level 1 model of Decisional Balance for cannabis

LEVEL 2.

The level 2 model of DB for cannabis (see Figure 5.18) incorporates the predictor variable of anxiety and regression weights were examined. In this model, the path from the anxiety variable to the intercepts for both *pros* (intercept = .34, $p < .001$) and *cons* (intercept = .35, $p < .001$) *for change* showed significant group differences at baseline. This indicates that the anxiety group initially reported higher perceived importance of both *pros* and *cons for change* than the non-anxiety group. When the paths from the anxiety variable to slopes for these constructs were reviewed there was not a significant

group difference in the rate of change for *pros for change* over time. However, the slope for *cons for change* (Estimate: -.06, $p < .001$) was significant, indicating that the anxiety group's decrease in perceived importance of *cons for change* occurred at a lower rate than the non-anxiety group.

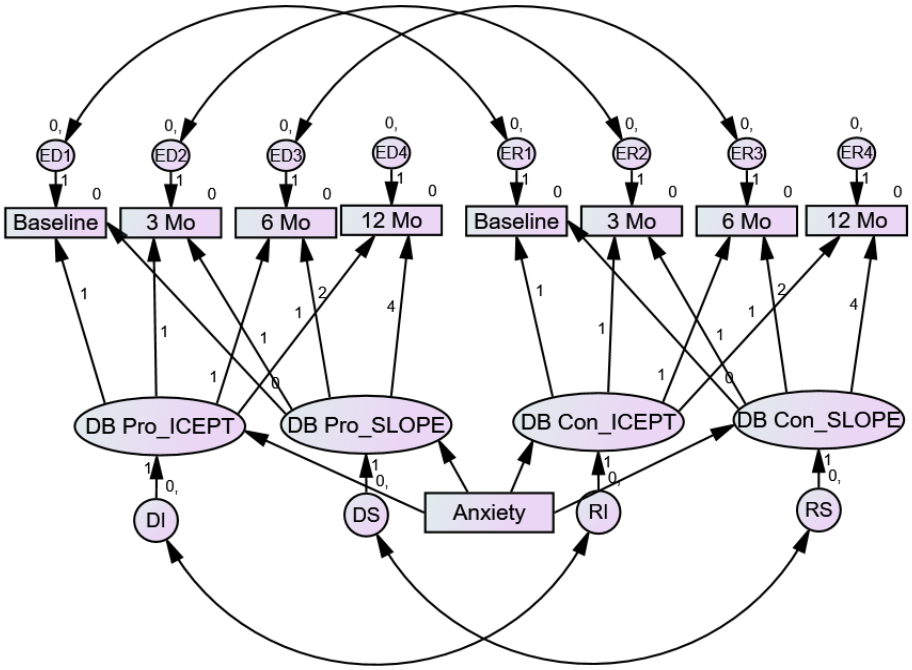

Figure 5.18. Level 2 model of Decisional Balance for cannabis

Cannabis Processes of Change

CONCEPTUAL MODEL.

The conceptual model of POC for cannabis (see Figure 5.19) was first run with the complete data set and did not achieve sufficient model fit (see Table5.22). Modification indices suggested covarying the *experiential* processes of change intercept (EXP_ICEPT) to the *behavioral* processes of change intercept (BEH_ICEPT) as well as the *experiential* slope (EXP_SLOPE) to the *behavioral* slope (BEH_SLOPE). However, model fit was still not achieved, and modification indices further suggested covarying time points 1 (ED1 to ER1), 2 (ED2 to ER2), and 3 (ED3 to ER3) between the constructs. Covariances were then examined, showing that the paths from the *experiential* intercept (EXP_ICEPT) to *experiential* slope (EXP_SLOPE), as well as *behavioral* intercept (BEH_ICEPT) to *behavioral* slope (BEH_SLOPE) were not significant. These non-significant paths indicate that participants' rate of change over time in how they engaged in *experiential* and *behavioral* processes of change was not significantly affected by where they started on either construct. Therefore, these paths were removed.

Table 5.22

LGC Cannabis POC TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**POC**					
1	**Base Model (Run with no missing data)**	1	876.5	26	.491	.377
	Covaried: Conf ICEPT and Temp ICEPT; Conf SLOPE and Temp Slope; ED3 and ER3; ED2 and ER2; ED1 & ER1	2	62.1	23	.977	.086
	Eliminated: Conf ICEPT and Conf SLOPE; Temp ICEPT and Temp SLOPE					
	Complete Data Model (Run with missing data)	3	72.7	23	.975	.074
2	**Anxiety Model**	4	72.6	27	.978	.065

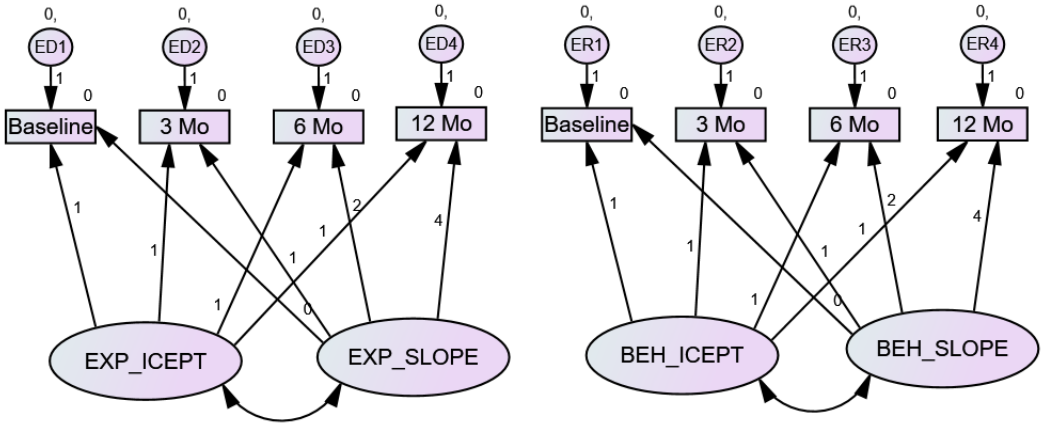

Figure 5.19. Conceptual model of Processes of Change for cannabis

LEVEL 1.

In the Level 1 POC model for cannabis (see Figure 5.20), means for both *experiential* and *behavioral* intercepts were significant, as well as the *experiential* slope, indicating that participants initially reported greater use of *behavioral* processes (Estimate: 1.93, $p < .001$) than the *experiential* processes (Estimate: 1.76, $p < .001$) and that over time, participants reported a significant decrease in their use of *experiential* processes (Estimate: -.04, $p < .001$). Covariances for this model showed the intercept for *experiential* processes of change was positively related to the intercept for *behavioral*

processes of change (Estimate: .29, $p < .001$). This indicates that participants who reported more engagement in *experiential* processes also reported more engagement in *behavioral* processes. Additionally, *experiential* the slope for experiential processes was positively related to the *behavioral* slope (Estimate: .02, $p < .001$). An examination of mean scores over time indicated that participants reported decreased engagement in *experiential* and *behavioral* processes over time, meaning that as participants reported a decrease in their use of *experiential* processes, they also reported a decrease in their use of *behavioral* processes.

An examination of variances showed that intercepts for both *experiential* (Estimate: .27, $p < .001$) and *behavioral* (Estimate: .41, $p < .001$) processes of change significant, as were the slopes for both *experiential* (Estimate: .02, $p < .001$) and behavioral (Estimate: .03, $p < .001$) processes. This indicates that there was significant variation between participants at the starting points for both *experiential* and *behavioral* processes; and that participants significantly differed in their rate of change for both processes of change over time. This variation was further explored using a predictor variable, i.e., dividing participants into anxiety and non-anxiety groups, as shown a Level 2 model (See Figure5.21).

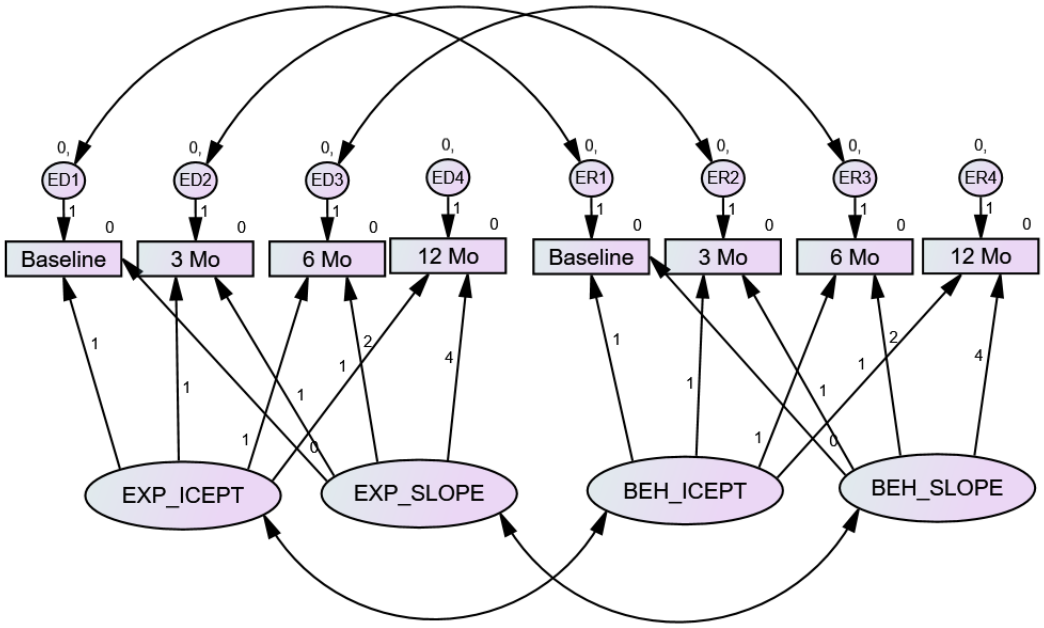

Figure 5.20. Level 1 model of Processes of Change for cannabis

LEVEL 2.

Results from the level 2 model of POC for cannabis (see Figure 5.21) show that the paths from the anxiety variable to the intercepts for both the *experiential* (intercept = .31, $p < .001$) and *behavioral* (intercept = .37, $p < .001$) processes were significant. This indicates that the anxiety group reported higher use of both processes at baseline. However, the paths from the anxiety construct to the slopes for the *experiential* and *behavioral* processes were not significant, meaning the groups' rates of change did not differ significantly from each other in their use of *experiential* or *behavioral* processes.

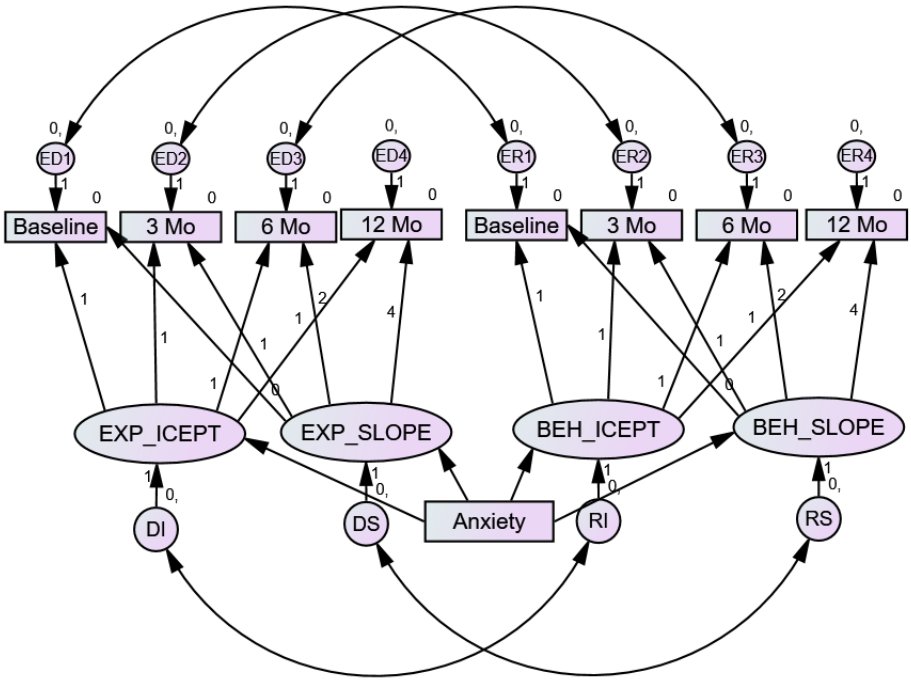

Figure 5.21. Level 2 model of Processes of Change for cannabis

Cannabis Readiness

CONCEPTUAL/LEVEL 1 MODEL.

The conceptual model of readiness for cannabis (see Figure 5.22) was first run with the complete data set and did not achieve sufficient model fit. Modification indices did not suggest any changes to this model. Because no alterations were made to the conceptual model, it also represents the level 1 model. Although, model fit was not initially achieved in the conceptual/level 1 model using the partial data set (no missing

data), it was later achieved using the complete data set. Model fit further improved with the addition of the predictor variable in the level 2 model. Means were examined and showed the *readiness* intercept was significant (Estimate: 5.02, $p < .001$), while the *readiness* slope was not, indicating participants' readiness to change over time did not differ. Covariances from this model showed that the *readiness* intercept was negatively related to the *readiness* slope (Estimate: -.28, $p = .008$), indicating that the higher participants rated their initial readiness to change, the more it decreased over time.

An examination of variances showed both the *readiness* intercept (Estimate: 1.68, $p < .001$) and slope (Estimate: .13, $p < .001$) were significant. This indicates that there was significant variation between participants at the starting points for *readiness*; and that participants' *readiness* significantly differed in rate of change over time. This variation is further explored using a predictor variable that divided participants into anxiety and non-anxiety groups, as shown in the level 2 model (see Figure 5.23).

Table 5.23

LGC Cannabis Readiness TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**Readiness**					
1	**Base Model (Run with no missing data)**	1	37.3	8	.931	.131
	Covaried:	2	37.3	8	.931	.131
	none					
	Eliminated:					
	None					
	Complete Data Model (Run with missing data)	3	35.4	8	.942	.093
2	**Anxiety Model**	4	36.3	10	.948	.082

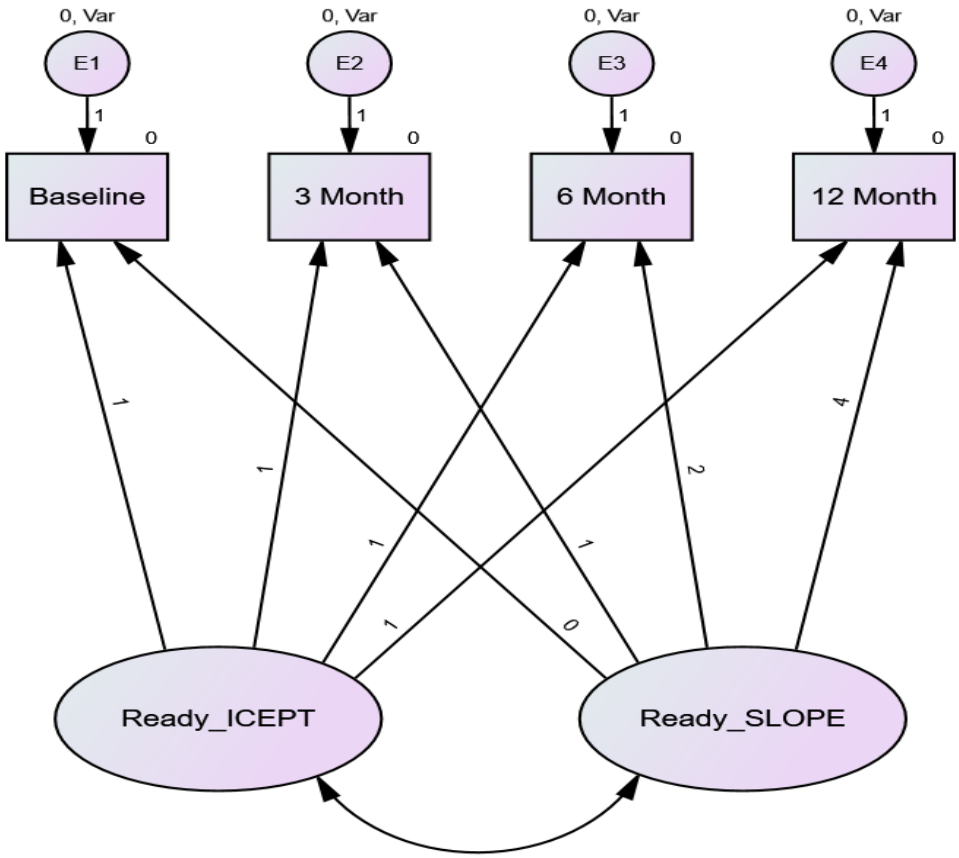

Figure 5.22. Conceptual and Level 1 model of Readiness for cannabis

LEVEL 2.

In the level 2 model of readiness for cannabis (see Figure 5.23) the significance of the path from the anxiety variable to the *readiness* intercept indicates that at baseline the

anxiety group reported higher readiness to change than the non-anxiety group (Estimate: 1.68, $p < .001$). The path from the anxiety variable to the *readiness* slope was also significant (Estimate: -.25, $p < .001$), indicating that participants with anxiety reported a lower rate of change in their readiness to change than those without anxiety. Mean scores over time were examined and showed that participants tended to report a decrease in readiness to change over time. In other words, while participants overall showed a decrease in readiness to change over time, the anxiety group's readiness to changed decreased at a slower rate.

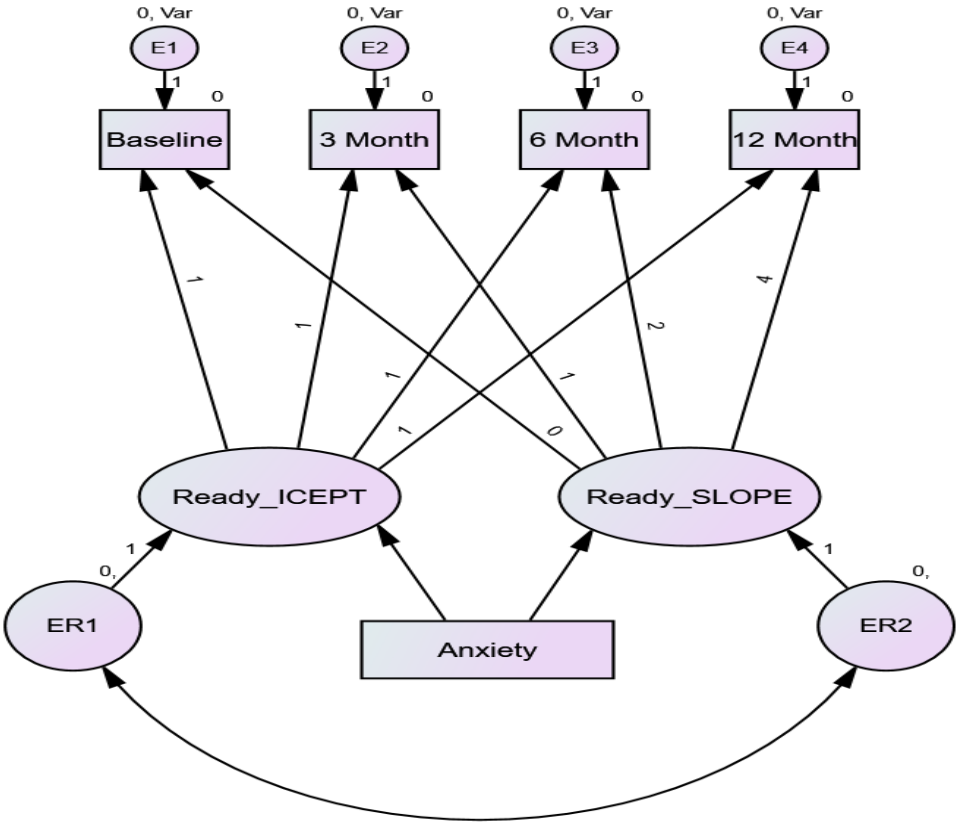

Figure 5.23. Level 2 model of Readiness for cannabis

To aid in interpretation of the LGC results from the TTM constructs listed above (i.e., *confidence* and *temptation*, *pros* and *cons of change*, *experiential* and *behavioral processes of change*, and *readiness to change*) Table 5.24 presents a summary of LGC findings for cannabis.

Table 5.24

LGC Summary Table of TTM constructs for cannabis

LEVEL 1	**Confidence**	**Temptation**	**Pros for Change**	**Cons for Change**	**Experiential**	**Behavioral**	**Readiness**
Means							
Intercept	**3.06*****	**2.59*****	**2.11*****	**1.65*****	**1.76*****	**1.93*****	**5.02*****
Slope	**.05****	**-.06*****	**-.08*****	-.03	**-.04*****	.01	-.01
Covariance							
Intercept	Conf <-->Temp		Pros <-->Cons		Exp <-->Beh		Ready_ICEPT
Estimate	**-.50*****		**.16*****		**.29*****		<-->
Slope	Conf <-->Temp		Pros <-->Cons		Exp <-->Beh		Ready_SLOPE
Estimates	**-.03*****		**.01*****		**.02*****		**-.28****
Variance							
Intercept	**.59*****	**.66*****	**.44*****	**.27*****	**.27*****	**.41*****	**4.47*****
Slope	**.05*****	**.03*****	<.01	**.03*****	**.02*****	**.03*****	**.13*****

LEVEL 2	**Confidence**	**Temptation**	**Pros for Change**	**Cons for Change**	**Experiential**	**Behavioral**	**Readiness**
Regression Weights							
Intercept path	**-.31****	**.41*****	**.34*****	**.35*****	**.31*****	**.37*****	**1.68*****
Slope path	-.05	-.05	-.04	**-.06***	-.03	.02	**-.25*****

Note: p = * < .05, ** < .01, *** < .001. Level 2 values are derived from unstandardized regression weights

Cocaine Conf and Temp

CONCEPTUAL MODEL.

The conceptual model of confidence and temptation for cocaine (see Figure 5.24) was first run with the complete data set and did not achieve sufficient model fit (see Table 5.25). Modification indices suggested covarying the *confidence* intercept (Conf_ICEPT) to the *temptation* intercept (Temp_ICEPT). Modification indices further suggested covarying time points 1 (ED1 to ER1) and 3 (ED3 to ER3). Covariances were then examined, showing that the paths form the *confidence* intercept (Conf_ICEPT) to the *confidence* slope (Conf_SLOPE) as well as the *temptation* intercept (Temp_ICEPT) to the *temptation* slope (Temp_SLOPE) were not significant. These non-significant paths indicate that participants' rate of change over time for confidence and temptation were not significantly affected by where they started on either construct. Therefore, these paths were removed for the Level 1 model (see Figure 5.25).

Table 5.25

LGC Cocaine Self-Efficacy TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**Conf & Temp**					
1	**Base Model (Run with no missing data)**	1	127.8	26	.642	.258
	Covaried: Conf ICEPT and Temp ICEPT; ED3 and ER3; ED1 & ER1	2	31.3	25	.978	.065
	Eliminated: Conf ICEPT and Conf SLOPE; Temp ICEPT and Temp SLOPE					
	Complete Data Model (Run with missing data)	3	46.9	25	.924	.047
2	**Anxiety Model**	4	52.1	29	.920	.045

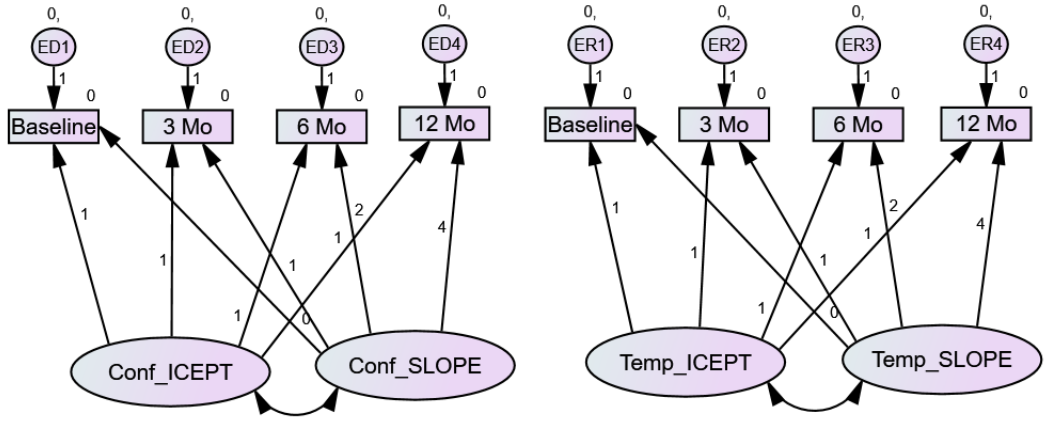

Figure 5.24. Level 1, base model of Confidence and Temptation for cocaine

LEVEL 1.

Means from the level 1 model of confidence and temptation for cocaine showed that both *confidence* and *temptations* intercepts and slopes were significant. Specifically, participants initially reported higher levels of confidence (Estimate: 3.45, $p < .001$) than temptations (Estimate: 2.08, $p < .001$) and over time, participants reported significant increases in confidence (Estimate: .09, $p = .002$) and significant decreases in temptations (Estimate: -.06, $p = .050$). Covariances from this model showed that the intercept for *confidence* was negatively related to the intercept for *temptation* (Estimate: -.48, $p <$

.001). This indicates that participants who started at higher levels of confidence, started at lower levels of temptations.

An examination of variances showed significant intercepts for both *confidence* (Estimate: .57, $p < .001$) and *temptations* (Estimate: .51, $p < .001$). Although the slope for *confidence* (Estimate: .03, $p = .030$) was also significant, the slope for temptation was not. This indicates that there was significant variation between participants at the starting points for both *confidence* and *temptations*. The slopes show that participants differed significantly in their rate of change for *confidence* over time but not for *temptations*. This variation was further explored using a predictor variable by dividing participants into anxiety and non-anxiety groups, as shown in the level 2 model (see Figure 5.26).

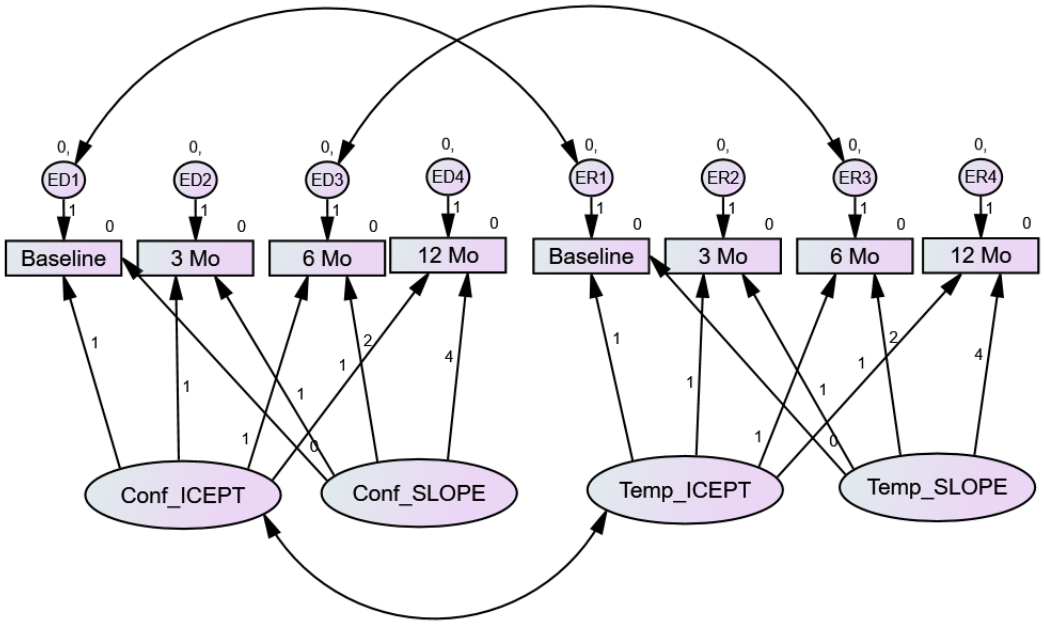

Figure 5.25. Level 1 model of Confidence and Temptation for cocaine

LEVEL 2.

The level 2 model of confidence and temptation for cocaine incorporates the predictor variable of anxiety, and regression weights were examined (see Figure 5.26). In this model, only the path from the anxiety variable to the intercept for *temptation* (Estimate: .42 p = .031) was significant, meaning the anxiety group initially reported higher levels of *temptation* than the non-anxiety group. However, the path from the anxiety variable to the intercept for confidence was not significant indicating that initially the anxiety group did not differ from the non-anxiety group in confidence. Furthermore, neither of the paths

from the anxiety variable to the slopes for *confidence* nor *temptation* were significant, indicating that the anxiety and non-anxiety groups did not differ significantly in their rate of change for either construct over time.

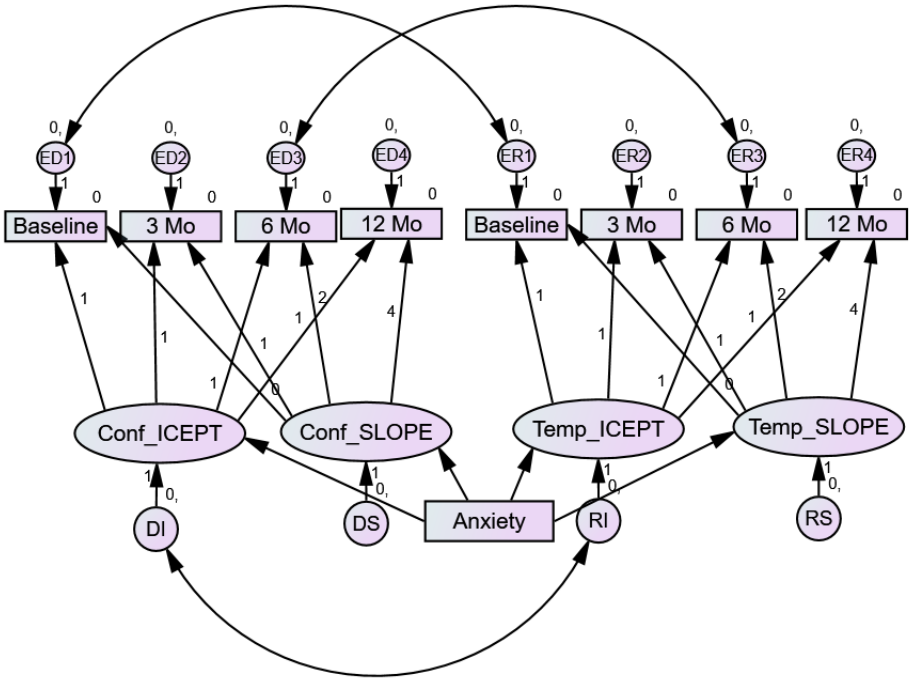

Figure 5.26. Level 2 model of Confidence and Temptation for cocaine

Cocaine Decisional Balance

CONCEPTUAL MODEL

The conceptual model of DB for cocaine (see Figure 5.27) was first run with the partial data set (no missing data) and did not achieve sufficient model fit (see Table 5.26). Modification indices suggested covarying the *pros for change* intercept (DBPro_ICEPT) to the *cons for change* intercept (DBCons_ICEPT) as well as the *pros for change* slope (DBPro_SLOPE) to the *cons for change* slope (DBCons_SLOPE). Modification indices further suggested covarying time points 2 (ED2 to ER2) and 3 (ED3 to ER3). Covariances showed that the paths from the *pros for change* intercept (DBPros_ICEPT) to *pros for change slope* (DBPros_SLOPE), as well as *cons for change* intercept (DBCons_ICEPT) to *cons for change* slope (DBCons_SLOPE) were not significant. These non-significant paths indicate that participants' rate of change over time in how their perceived importance of *pros* or *cons for change* was not significantly affected by where they started on either construct. Therefore, these paths were removed for the level 1 model (see Figure 5.28).

Table 5.26

LGC Cocaine DB TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**DB**					
1	**Base Model (Run with no missing data)**	1	95.7	26	.573	.221
	Covaried: Conf ICEPT and Temp ICEPT; Conf SLOPE and Temp Slope; ED3 and ER3; ED2 and ER2	2	14.9	24	1.00	.000
	Eliminated: Conf ICEPT and Conf SLOPE; Temp ICEPT and Temp SLOPE					
	Complete Data Model (Run with missing data)	3	18.0	24	1.00	.000
2	**Anxiety Model**	4	21.6	28	1.00	.000

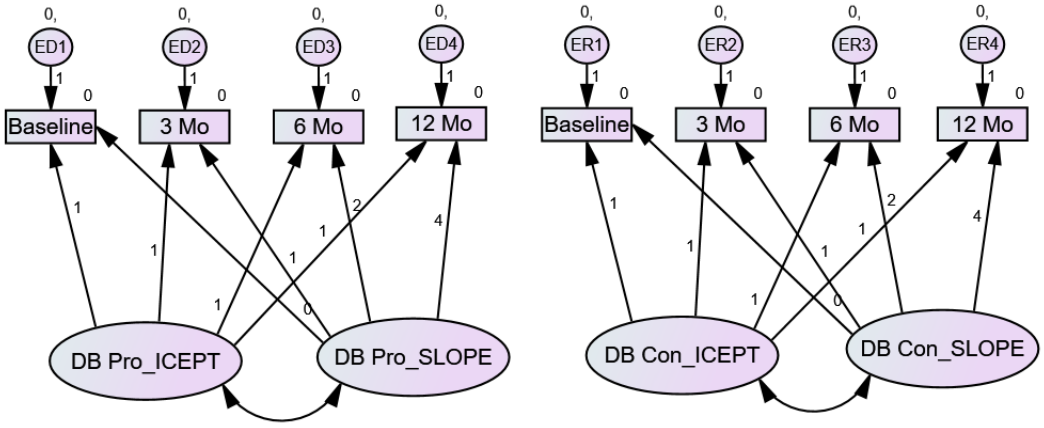

Figure 5.27. Conceptual model of Decisional Balance for cocaine

LEVEL 1.

Means form the level 1 model of DB for cocaine (see Figure 5.28) showed that both the intercepts for *pros* and *cons for change* were significant, with participants initially reporting greater *cons for change* (Estimate: 2.33, $p < .001$), than *pros for change* (Estimate: 1.75, $p < .001$). However, neither the slopes for *pros* nor *cons for change* were significant, meaning participants did not report significant changes in *pros* or *cons for change* over time. Covariances from this model showed that the intercept for *pros for change* was positively related to the intercept for *cons for change* (Estimate: .19,

p = .008). This indicates that participants who rated perceived importance in *pros for change* higher, also rated perceived importance in *cons for change* higher. Futhermore, the slopes for *pros* and *cons for change* were positively related (Estimate: .04, $p < .001$). Mean scores over time indicated that participants reported a decrease in perceived importance of *pros* and *cons for change* over time, suggesting that as participants decreased their perceived importance of *pros for change*, they experienced a similar rate of decrease in their perceived importance of *cons for change*.

Variances showed that the intercepts for both *pros for change* (Estimate: .31, $p < .001$) and *cons for change* (Estimate: .44, $p < .001$) were significant. This indicates significant variation between participants at the starting points for both *pros* and *cons for change*. Additionally, the slopes for both *pros for change* (Estimate: .033, $p = .003$) and *cons for* change (Estimate: .44, p = .003) were significant, meaning that participants differed significantly in their rate of change of perceived importance of both *pros* and cons *for change* over time. This variation was further explored using a predictor variable by dividing participants into anxiety and non-anxiety groups for the level 2 model (see Figure 5.29).

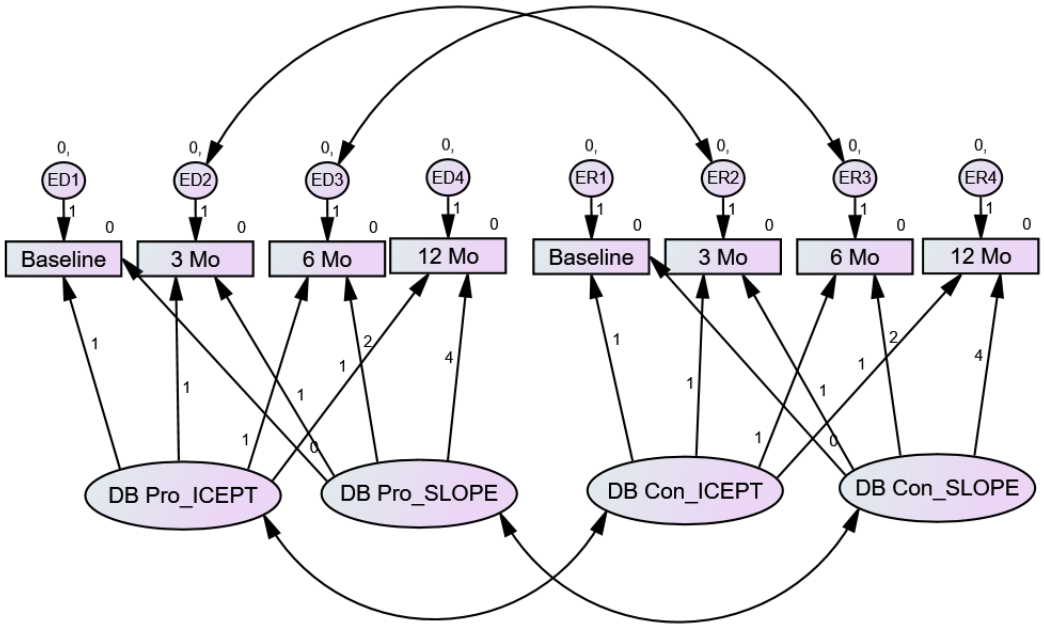

Figure 5.28. Level 1, model 3 of Decisional Balance for cocaine

LEVEL 2.

The level 2 model incorporates the predictor variable of anxiety and regression weights were examined. In this model, only the path from the anxiety variable to the intercept for *cons for change* (Estimate: .66, $p < .001$) showed significant group differences. This indicates that the anxiety group initially reported higher perceived importance of *cons for change* than the non-anxiety group. The paths from the anxiety variable to the slopes for these constructs were not significant, meaning that the groups did not differ significantly in rate of change over time for *pros* or *cons for change*.

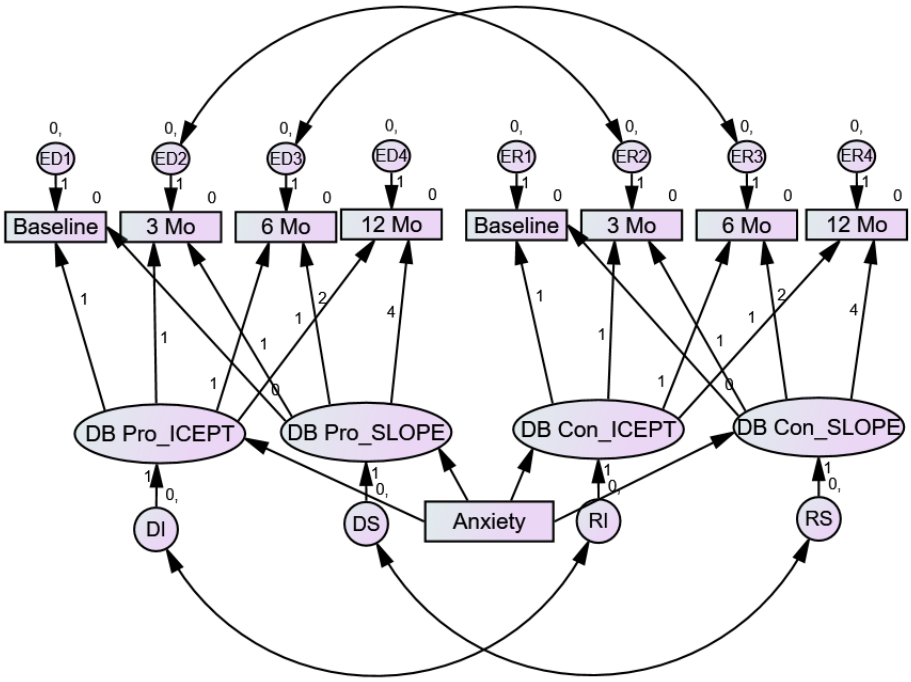

Figure 5.29. Level 2, model 4 of Decisional Balance for cocaine

Cocaine Processes of Change

CONCEPTUAL MODEL.

The conceptual model of POC for cocaine (see Figure 5.30) was first run with the complete data set and did not achieve sufficient model fit (see Table 5.27). Modification indices suggested covarying the *experiential* processes of change intercept (EXP_ICEPT) to the *behavioral* processes of change intercept (BEH_ICEPT) as well as the *experiential* slope (EXP_SLOPE) to the *behavioral* slope (BEH_SLOPE). However, model fit was still not achieved, and modification indices further suggested covarying time points 2

(ED2 to ER2) and 3 (ED3 to ER3). Covariances from this model showed that the paths from the *experiential* intercept (EXP_ICEPT) to *experiential* slope (EXP_SLOPE), as well as *behavioral* intercept (BEH_ICEPT) to *behavioral* slope (BEH_SLOPE) were not significant. These non-significant paths indicates that participants' rate of change over time in how they engaged in *experiential* and *behavioral* processes of change was not significantly affected by where they started on either construct. Therefore, these paths were removed for the level 1 model (see Figure 5.31).

Table 5.27

LGC Cocaine POC TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**POC**					
1	**Base Model (Run with no missing data)**	1	246.3	26	.537	.379
	Covaried: Exp ICEPT and Beh ICEPT; Exp SLOPE and Beh Slope; ED3 and ER3; ED2 and ER2 **Eliminated:** Conf ICEPT and Conf SLOPE; Temp ICEPT and Temp SLOPE	2	38.3	24	.970	.100
	Complete Data Model (Run with missing data)	3	44.5	24	.967	.047
2	**Anxiety Model**	4	46.3	28	.971	.041

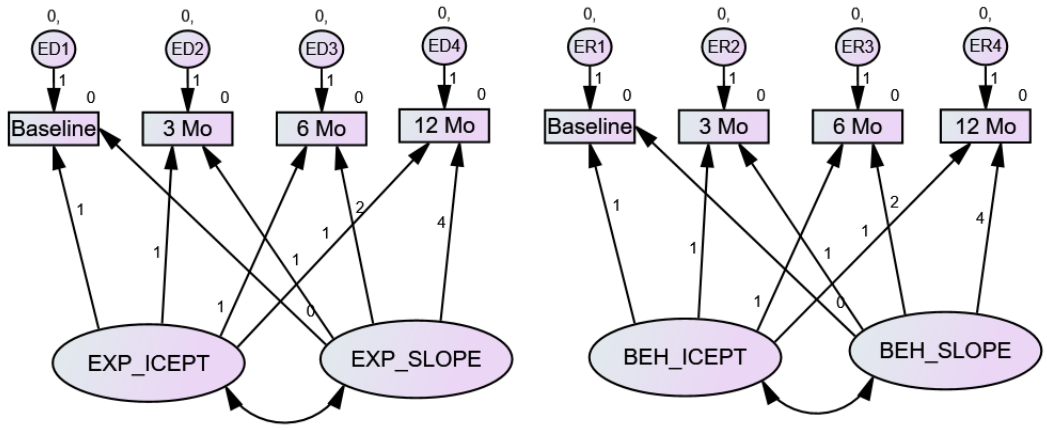

Figure 5.30. Conceptual model of Processes of Change for cocaine

LEVEL 1.

The means from the level 1 model of POC for cocaine (see Figure 5.31) showed that the *experiential* and *behavioral* intercepts were significant. Specifically, participants initially reported greater use of *behavioral* processes (Estimate: 2.70, $p < .001$), than the *experiential* processes (Estimate: 2.69, $p < .001$). However, neither the slope for the *experiential* nor the *behavioral* processes of change was significant, meaning participants did not report significant changes in their use of either the *experiential* or *behavioral* processes of change over time. Covariances from this model revealed that the intercept

for *experiential* processes of change was positively related to the intercept for *behavioral* processes of change (Estimate: .72, $p < .001$). This indicates that participants who initially had greater engagement in *experiential* processes also initially had greater engagement in *behavioral* processes. Additionally, the *experiential* slope was positively related to the *behavioral* slope (Estimate: .04, $p < .001$). An examination of mean scores over time indicated that participants reported a decrease in engagement with *experiential* and an increase in *behavioral* processes over time, meaning that when participants reported a decrease in their use of *experiential* processes, they also reported an increase in their use of *behavioral* processes.

An examination of variances showed that the intercepts for both *experiential* (Estimate: .73, $p < .001$) and *behavioral* (Estimate: .83, $p < .001$) processes of change were significant, as were the slopes for both *experiential* (Estimate: .04, $p < .001$) and *behavioral* (Estimate: .06, $p < .001$) processes of change. This indicates that there was significant variation between participants at the starting points for both *experiential* and *behavioral* processes and that participants differed significantly in their rate of change for both processes of change over time. This variation was further explored using a predictor variable by dividing participants into anxiety and non-anxiety groups, as shown in the level 2 model (see Figure 5.32).

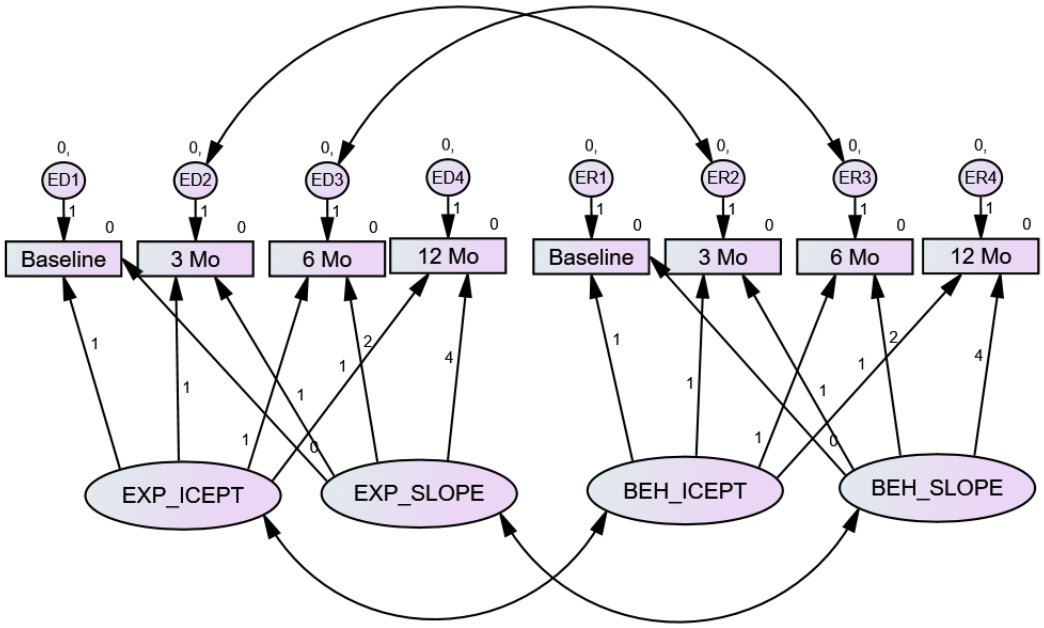

Figure 5.31. Level 1 model of Processes of Change for cocaine

LEVEL 2.

The level 2 model of POC for cocaine (see Figure 5.32) showed that the paths from the anxiety variable to the intercepts for both the *experiential* (Estimate: .83, $p < .001$) and *behavioral* (Estimate: .57, $p < .001$) processes were significant. This indicates that the anxiety group reported higher use of both processes at baseline. However, the paths from anxiety to the slopes for the *experiential* and *behavioral* processes were not significant, indicating that the groups differed significantly in their rate of change for use of *experiential* and *behavioral* processes.

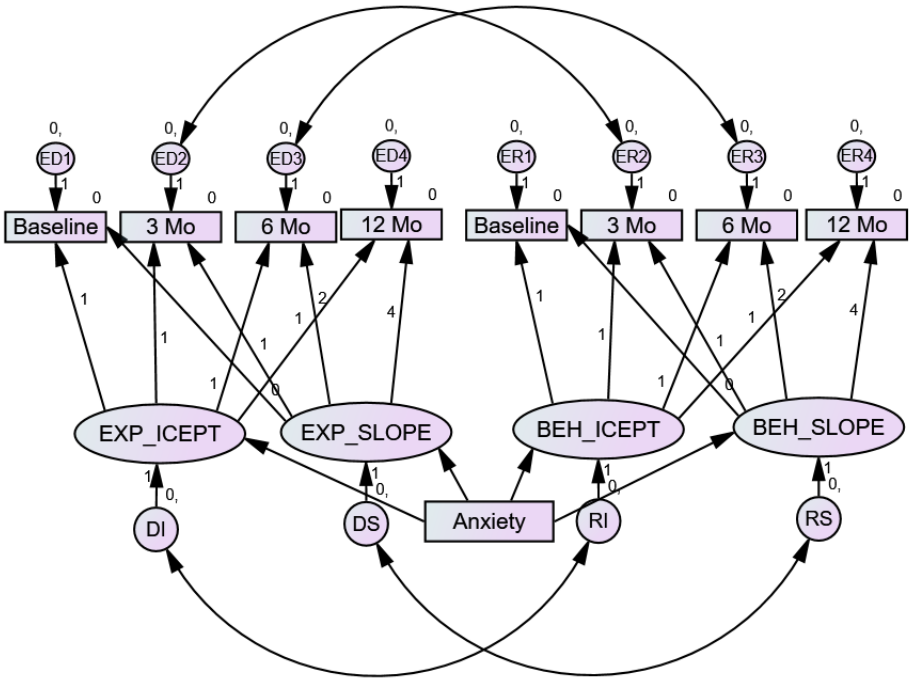

Figure 5.32. Level 2 model of Processes of Change for cocaine

Cocaine Readiness

CONCEPTUAL/LEVEL 1 MODEL.

The conceptual model of readiness to change for cocaine (see Figure 5.33) was first run with the partial data set (no missing data), which produced good model fit (see Table 5.28). However, modification indices were examined and covariances showed the path from the *readiness* intercept (Ready_ICEPT) to the *readiness* slope (Ready_SLOPE) was not significant. Typically, this would indicate the path should be removed, however,

the model was examined both with and without the path for the level 2 model and model fit was no-longer achieved when the path was removed. Therefore, due to the lack of model fit without the path in the level 2 model, as well as the high model fit throughout the conceptual and level 1 model with the path, the path was retained. Because no alterations were made to the conceptual model, it also represents the Level 1 model.

Means from this model were examined and both the *readiness* intercept (Estimate: 7.19, $p < .001$) and the *readiness* slope (Estimate: -.15, $p = .046$) were significant, indicating a significant decrease in participants' readiness to change over time. Covariances from this model were also examined, but none were significant. This indicates that there was not a significant difference in how participants rated their initial readiness to change and how their readiness changed over time.

An examination of variances showed the *readiness* intercept (Estimate: 5.63, $p < .001$) was significant. This indicates that there was significant variation between participants at the starting points for *readiness*. However, the *readiness* slope was not significant, indicating that participants' *readiness* did not differ in rate of change over time. However, possible variation between groups was further explored using a predictor variable dividing participants into anxiety and non-anxiety groups as shown in the level 2 model (see Figure 5.34).

Table 5.28

LGC Cocaine Readiness TTM Variable Modification Table

Model Level	Model Description	Model	X^2	Df	CFI	RMSEA
1	**Readiness**					
1	**Base Model (Run with no missing data)**	1	7.8	8	1.00	.000
	Covaried: none	2	7.8	8	1.00	.000
	Eliminated: None (Suggested but retained: Ready ICEPT and Ready SLOPE)					
	Complete Data Model (Run with missing data)	3	7.4	8	1.00	.000
2	**Anxiety Model**	4	10.3	10	.998	.008

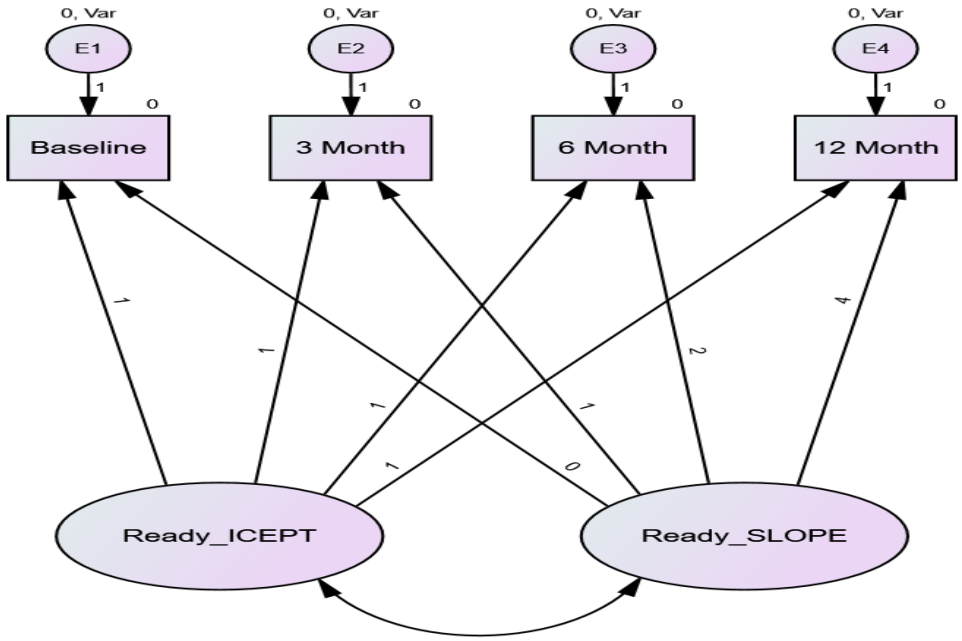

Figure 5.33. Conceptual and level 1 model of Readiness for cocaine

LEVEL 2.

In the level 2 model of readiness to change for cocaine (see Figure 5.34), only the path from the anxiety variable to the *readiness* intercept was significant (Estimate: 1.50, p = .010), indicating that the anxiety group reported higher readiness to change at baseline than the non-anxiety group. Because the path from the anxiety variable to the *readiness* slope was not significant, the anxiety and non-anxiety groups do not appear to differ on reported rate of change over time in their readiness to change.

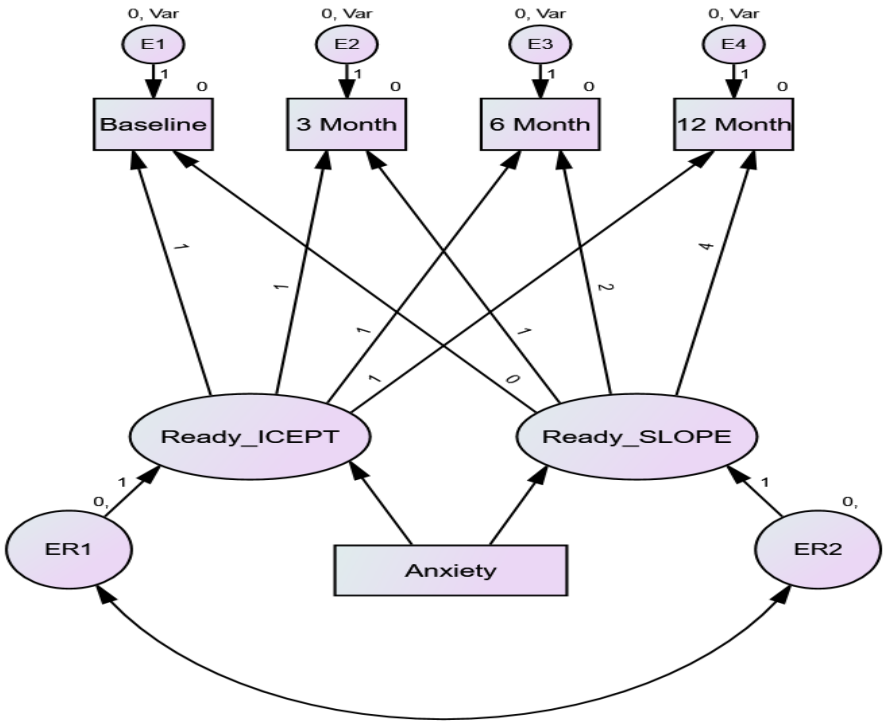

Figure 5.34. Level 2 model of Readiness for cocaine

To aid in interpretation of the LGC results from the TTM constructs listed above (i.e., *confidence* and *temptation*, *pros* and *cons of change*, *experiential* and *behavioral processes of change*, and *readiness to change*) Table 5.29 presents a summary of LGC findings for cocaine.

Table 5.29

LGC Summary Table of TTM constructs for cocaine

LEVEL 1	**Confidence**	**Temptation**	**Pros for Change**	**Cons for Change**	**Experiential**	**Behavioral**	**Readiness**
Means							
Intercept	**3.45*****	**2.08*****	**1.75*****	**2.33*****	**2.70*****	**2.70*****	**7.20*****
Slope	**.09****	**-.06***	-.01	-.02	-.02	.02	**-.15***
Covariance							
Intercept	Conf <-->Temp		Pros <-->Cons		Exp <-->Beh		Ready_ICEPT
Estimate	**-.48*****		**.04*****		**.72*****		<-->
Slope	None		Pros <-->Cons		Exp <-->Beh		Ready_SLOPE
Estimate	--		**.19****		**.04*****		-.41
Variance							
Intercept	**.57*****	**.51*****	**.31*****	**.44*****	**.73*****	**.83*****	**4.56*****
Slope	**.03****	.01	**.03****	**.06****	**.04*****	**.06*****	**.08**

LEVEL 2	**Confidence**	**Temptation**	**Pros for Change**	**Cons for Change**	**Experiential**	**Behavioral**	**Readiness**
Regression Weights							
Intercept path	-.30	**.42***	.25	**.66****	**.73*****	**.83*****	**1.50****
Slope path	-.03	-.01	-.07	-.03	**.04*****	**.06*****	-.09

Note: p = * < .05, ** < .01, *** < .001. Level 2 values are derived from unstandardized regression weights.

VI. DISCUSSION

SUDs and ADs are highly prevalent among adults in the United States and each contributes to significant health, financial, and social problems around the world. Alcohol and illicit drug use, including marijuana, are associated with substantial burden through impairment in major life roles and increased risk for suicidality, neuropsychological deficits, diminished quality of life, and infectious disease (e.g., human immunodeficiency virus and hepatitis) (Grant, Saha, Ruan, et al., 2016). In addition, systematic reviews of yearly and lifetime prevalence showed that those diagnosed with anxiety disorders also often experience significant life altering impairments (Baxter, Scott, Vos, & Whiteford, 2012).

Given that SUDs and ADs are some of the most prevalent psychological disorders, it is not surprising to find that these conditions often co-occur, and exacerbate each other (Conway, Swendsen, Husky, He, & Merikangas, 2016). Moreover, when found together, each disorder may significantly hinder treatment of the other, especially considering that those with a comorbid SUD and AD are significantly less likely to seek or accept care for either disorder (Melchoir, Prokofyeva, Younes, Surkan, & Martins, 2014). As a result of these significant concerns, researchers and clinicians have been working to further understand and better treat comorbid SUD and AD. It has therefore been the aim of this dissertation to further understand how these disorders impact each other. This dissertation specifically focused on the effects of anxiety on substance use outcomes, and examined differences in the process of change regarding substance use for those with and without clinically significant levels of anxiety. This dissertation also aims to provide

recommendations for future research and clinical care regarding the treatment of these co-occurring disorders.

The transtheoretical model has provided a sturdy platform to study both the behaviors and treatments of these disorders. Using TTM, this dissertation examined two areas of interest. The first was to identify *if the presence of anxiety impacts substance use outcomes over time.* In other words, do people with anxiety experience the same reduction in substance use over time compared to those without anxiety. The second was to examine if *the process of changing drug use differed for those with anxiety compared to those who do not endorse anxiety, using the transtheoretical model.* For instance, do those without anxiety identify greater levels of confidence in their ability to remain abstinent throughout treatment than those with anxiety?

Anxiety's Impact on Substance Use Outcomes

Researchers have consistently found that when ADs and SUDs co-occur, individuals are more likely to report greater substance use prior to treatment, as well as higher rates of relapse throughout and after treatment (Driessen et al., 2001; Ouimette et al., 1997) Based on this and other current literature cited in the initial chapters of this dissertation, it was hypothesized that individuals who endorse anxiety would be more likely to endorse higher substance use at four different time points (baseline, 3-, 6-, and 12-month follow-ups).

Several analyses were preformed to test these assumptions, including baseline T-tests and repeated measures analyses of four substance categories (*alcohol*, *cannabis*,

cocaine, and *any drug*), at the four different time points. Findings from these analyses generally supported conclusions from the previous literature with a few exceptions. While findings from this study were consistent in showing that participants with anxiety reported greater alcohol and cocaine use at intake and generally throughout the next three time points, this was not the case for those who used cannabis or when *any drug* use was the variable of interest. Rather, there was no discernable difference in substance use between the anxiety and non-anxiety groups in the *any drug* use category; and for those who used cannabis, the anxiety group actually reported more days abstinent at baseline than the non-anxiety group. These findings were further supported through the repeated measures analysis showing the anxiety group reported more PDA from cannabis use at baseline, 3 months, and at 12 months.

The initial differences between substance use by those with anxiety compared to those without, as well as the consistency of substance use patterns over time between the anxiety and non-anxiety groups comparatively, suggests that anxiety's influence on substance use is likely drug specific. For instance, while much of the previous research found that comorbid participants had higher substance use at the start of treatment (Trafton, Minkel, and Humphres, 2006; (Mills, Teesson, Ross, & Darke, 2007; Farris, Epstein, McCrady, & Hunter-Reel, 2012), these findings may be limited by the fact that studies have largely focused on alcohol, cocaine, and opioid use. This highlights a gap in the literature, since studies focusing on anxiety and cannabis, and other substances such as cocaine and methamphetamines, remains sparse.

One reason for the divergent findings for *cannabis* use compared to *alcohol* and *cocaine* use between the two groups at baseline may be that *cannabis* may have effectively reduced anxiety in some users (Bergamaschi et al., 2011). It is possible that cannabis effectively helped some participants manage their anxiety symptoms prior to the study. If this is true, participants who self-medicated anxiety symptoms through cannabis use may not have endorsed enough symptomology on the BSI to be placed in the anxiety group. Therefore, some cannabis participants who should have been in the anxiety group, may have actually been placed in the non-anxiety group.

Another possible reason for this divergence is the opposite, that for some people cannabis use can actually exacerbate acute anxiety symptoms (Degenhardt, Hall, & Lynskey, 2001). In this case, cannabis use is reduced since it makes their anxiety worse. For example, in one study, participants in treatment for panic disorder reported more feelings of anxiety following cannabis use compared to those in treatment for depression and control groups (Szuster, Pontius, & Campos, 1988). Similar to cannabis, many other substances may also have negative effects on anxiety sufferers. In sum, those with anxiety are likely to over indulge in substances that have a medicating effect on their symptoms, while avoiding substances that exacerbate symptoms.

As for the category of *any drug use,* after examining findings it was clear that when analyzed all-together, group differences in the many different substances averaged out and no significant difference between anxiety and non-anxiety participants could be identified. Therefore, future studies should account for anxiety's impact on specific substances, rather than lump all substance use together.

Finally, while, on average, study participants reduced overall substance use by the final time point, there were group differences based on the drug examined. For example, by the final time point, *alcohol* and *cocaine* use did not significantly differ by anxiety group, but *cannabis* use did. Other results also differed by drug type. For example, *cannabis* and *alcohol* each showed significant group differences at three of the four time points, but *cocaine* use differed by group difference at only one time point, baseline. And no group differences were observed at any of the four time points for *any drug* use. Lastly, repeated measures analysis revealed that, of the four substance use categories, only *cocaine* had a significant substance use by anxiety group interaction across time. In other words, of the four substance use categories, it was only for *cocaine* that anxiety seemed to play a significant role in the actual change of substance use outcomes over time. Again, this points to the notion that anxiety's impact on substance use is drug specific suggesting that researchers should examine anxiety's relationships with each drug type separately.

Anxiety's Impact on the Process of Changing Substance Use

The second aim of this paper was to describe the impact of anxiety on the overall process of changing substance use behaviors, in accordance with the transtheoretical model (TTM). Studies have shown that progression through the processes of change for substance abusers consist of moving through a series of steps or phases, each of which address different issues and may require different strategies (DiClemente & Prochaska,

1998; DiClemente, Prochaska, & Gibertini, 1985; DiClemente et al., 1991; Prochaska et al., 1991, 1992; Prochaska Velicer, et al., 1994; Smit et al., 1995; Velasquez et al., 1999).

More to the point, movement toward change does not seem to come from repeating, or even increasing any one thing, rather it comes from emphasizing distinct change promoting elements throughout the process, depending on the behavior/substance that is targeted. For example, while promoting increased perceived importance of pros for change over cons for change may be valuable in the early stages of change, such as precontemplation and contemplation, too much focus on this instead of other change tactics may stifle advancement through later stages of change.

There are, however, some nearly universal *process markers* that indicate an individual is on track for successful change (Carbonari & DiClemente, 2000). According to previous work with the TTM, successful change elements tend to include: greater motivation or readiness to change, lower temptation to use a substance, higher confidence to abstain, higher ratings of pros for change and lower ratings cons for change, and use of the experiential and behavioral change processes (Prochaska, DiClemente, & Norcross, 1992; DiClemente & Carbonari, 1996).

With this understanding, it was predicted that different TTM construct profiles would emerge between those with and without anxiety for each substance use category. To this end, GLM profile analyses and latent growth curve analyses were performed for both cannabis and cocaine users in hopes of identifying distinct profiles and patterns of change using TTM constructs based on anxiety groupings. Findings generally supported these expectations.

First, there were distinct differences in the profiles of the cocaine and cannabis groups. Differences in both the overall TTM profiles and patterns of engagement with the TTM constructs were evident between the two groups. For instance, LGC analyses showed the two groups differed across all constructs initially and that the anxiety group's perceived importance of *cons for change* and readiness to change declined more slowly than the non-anxiety group over time.

Meanwhile, profile analyses showed that the anxiety group initially had higher *contemplation, action,* and *maintenance* scores; endorsed higher perceived importance for *pros* (except for cocaine users) and *cons for change*; reported lower *confidence* in their ability to change and greater *temptation* to continue engaging in the problem behavior; but endorsed greater use of both the *experiential* and *behavioral processes of change* compared to the non-anxiety group. Based on the profile differences between the groups at baseline, literature suggests that the anxiety group was poised to reduce their substance use at a greater rate than the anxiety group.

For instance, in looking at cannabis users, the anxiety group initially used less substance use compared to the non-anxiety group, had higher scores in each of the stages of change beyond pre-contemplation (contemplation, preparation, action, and maintenance), reported higher engagement in the decisional balance process (perceived importance of pros and cons), and engages more in the processes of change (experiential and behavioral). Conversely, the non-anxiety group has higher scores in the pre-contemplation stage, and less engagement in both decisional balance and processes of change.

All of these group differences indicate the anxiety group has higher overall readiness to change at baseline compared to the non-anxiety group. In fact, although not all constructs remain significant throughout the study, the pattern of the profiles remains consistent over the next three time points, and the anxiety group maintains a higher readiness to change over the non-anxiety group at all four time points. However, when outcome results are reviewed, a critical finding emerges. Although profile differences between groups would seem to indicate the anxiety group should have greater success in reduction of substances, there was no difference in rate change of substance use between the two groups. Although both the anxiety group and non-anxiety group significant reduced substance use over time, neither group reduced their use at a greater rate.

Given these findings, the question looms, if the anxiety group demonstrates a greater readiness to change, why does it change at the same rate as the non-anxiety group? To answer this question, it is important to look at each TTM construct, especially those of confidence and temptation, where across the four time points, the anxiety group reported significantly lower confidence in their ability to change and greater temptations to return to using compared to the non-anxiety group. A further understanding of the lack of differentiation in substance use change between groups can be found by specifically examining the final time point for the cannabis users. At this 12-month time point, the anxiety group reported significantly higher scores in contemplation, temptations to use, and both the experiential and behavioral processes of change. This seems to indicate that the anxiety group had difficulty progressing beyond the contemplation stage, even by the 12-month mark.

One explanation of lack of progression beyond the contemplation stage offered through TTM literature is that progression beyond the contemplation stage is largely based on decisional balance, or how a participant perceives pros and cons for change (Prochaska, Redding, Harlow, Rossi, & Velicer, 1994). Generally, progression through the stages begins with increased importance placed on *pros for change* compared to *cons for change* (specifically in the contemplation stage), followed by an overall decrease in importance of both *pros* and *cons for change* as the participant successfully moves into different stages of change (Connors et al., 2013). However, findings from this dissertation showed that while both groups showed a reduction in perceived importance of pros and cons for change over time, which would indicate the client is progressing onto the next stages of change (action or maintenance), the anxiety group's perceived importance of cons for change decreased at a lower rate than the non-anxiety group.

This is noteworthy because literature suggests that as an individual progresses through the stages of change, particularly beyond contemplation, there is generally a reduction of perceived importance place on both pros and cons for change (Connors et al., 2013). This reduction occurs because the individual has determined that the pros for change sufficiently outweigh the cons for change, likely because the perceived benefits of change outweigh the negative aspects of continuing the behavior, and the individual moves beyond considerations of pros and cons. However, in this case the anxiety group seemed to maintain their contemplation of the perceived importance of these pros and cons beyond the non-anxiety group. Thus, the anxiety group maintained a state of contemplation through ambivalence.

Another observed group difference was found in processes of change. The literature, specifies ten processes of change, five experiential and five behavioral (Connors et al., 2013). The primary difference between the experiential and behavioral processes is that the experiential processes are cognitive and affective while the behavioral processes require behavioral engagement (Velasquez, Crouch, Stephens, & DiClemente, 2016; Velicer, Prochaska, Fava, Norman, & Redding, 1998). Because the experiential processes of change are more thought driven, they are typically observed during the early part of behavior change when a person is debating whether to make a change or not, such as when the individual is in the contemplation stage (Velicer, Prochaska, Fava, Norman, & Redding, 1998). As the individuals moves into the preparation and action stages, they increase their engagement in the more active behavioral processes, such as changing their environment or substituting new behaviors for the one they are attempting to change (Velicer, Prochaska, Fava, Norman, & Redding, 1998). Though this is the typical situation, anxiety participants in this study were still engaging in the experiential processes at nearly the same rate as the behavioral processes.

In addition to anxiety participants suboptimal progression in processes of change, their lack of self-efficacy was also evident. Across all four time points the anxiety group consistently reported lower levels of confidence and greater levels of temptations. As literature has shown that self-efficacy is directly correlated with participants movement from pre-contemplation through all other stages including maintenance (Prochaska et al., 1991), anxiety participants' lack of self-efficacy may be the most important reason that they are not more successful in reducing substance use.

The observed TTM construct differences between the anxiety and non-anxiety groups, (i.e., pros and cons of change, confidence and temptation, and overall readiness to change) were first identified through profile analyses (PA). Although these observations were distinctly important, the confirmation of these differences through latent growth curve (LGC) analyses, which is a far more sensitive analysis for changes over time, is invaluable. For instance, LGC compared both groups together over time and confirmed that these differences, which were observed initially in PA, were also maintained over the 12 months of study. These findings together provide a strong basis for the assertion that self-efficacy and decisional balance are key factors for the lack of greater reduction of substance use that might otherwise have been observed for the anxiety group compared to the non-anxiety group.

Profile Differences Between Substances

An unexpected finding that emerged from this dissertation highlighted differences between the anxiety and non-anxiety groups based on substance use categories. While the shapes of the TTM profile patterns for the anxiety and non-anxiety group remained relatively similar for both cannabis and cocaine, differences of which, and how many, of the TTM constructs were significantly different over the four time points between the groups emerged for cannabis and cocaine. For instance, while both cannabis and cocaine showed nearly all TTM constructs to be significantly different between anxiety groups at baseline (9/10 significant constructs for cannabis and 8/10 for cocaine), by the 3-month time point, 8/10 constructs remained significant for cannabis, while only 2/10 constructs

were significant for cocaine. However, the differences between the substances seemed to dissipate by the final time point where both cannabis and cocaine each showed 4/10 constructs to be significant, though, the constructs themselves were different.

A possible explanation for the differences in profiles between the cannabis and cocaine users is that fewer participants used cocaine (*n*=86) than cannabis (*n*=310). Thus, statistical power due to the small sample size of the cocaine group may have been insufficient to detect differences between groups for each construct. Additionally, when reviewing substance outcomes, a large number of cocaine users reported a high percent of days abstinent, making it difficult to identify any real reduction in use over time. In other words, there may have been a ceiling effect for the cocaine group that was not apparent in the cannabis group. Lastly, it should be noted that most of the cocaine participants also endorsed cannabis use, and it is possible that these participants chose to focus on changing one substance over the other. Therefore, given the limiting conditions for cocaine, the following comments focus largely on cannabis profile results, as they seem to provide a clearer picture of change.

Ultimately, this study found that anxiety participants were as successful as non-anxiety participants in reducing their substance use at the 12-month follow-up. However, anxiety participants engaged with the TTM variables differently than non-anxiety participants. This was especially notable with the processes of change and self-efficacy variables. While anxiety participants did engage more in both experiential and behavioral processes of change, they seemed to over utilize experiential processes of change compared to behavioral processes at later time points. In addition, anxiety participants

reported lower confidence and greater temptation, effectively diminishing progress which may have promoted change. In summary, though both groups experiencing a similar reduction rate of substance use, anxiety participants engaged TTM variables differently than the non-anxiety participants.

Implications for Practice

Given that individuals diagnosed with both a SUD and an AD are prone to worse outcomes and generally benefit less from treatment, this study suggests modifications in treatment regimens could improve treatment outcomes and mark a significant step forward in comorbid care. First, this dissertation indicates that anxiety's impact on substance use outcomes were clearly dependent on the type of substance used. While anxiety participants initially reported increased cocaine and alcohol use compared to non-anxiety participants, the anxiety group reported less initial cannabis use than the non-anxiety group. Therefore, clinicians should consider current research pertaining to each substance to guide best treatment practices.

Next, this dissertation shows that while clients with anxiety may reduce substance use over time at rates similarly to those without anxiety, there are clear differences between how the two groups engage in TTM constructs and change over time. The anxiety group had higher scores in contemplation, lower confidence in their ability to change, and greater susceptibility to temptations to return to use. Taken together, this seems to have resulted in a perpetuation of ambivalence throughout months of the study, despite high motivations to change.

Put another way, while the anxiety group participants clearly showed a higher readiness to change from the beginning to the end of the study, their lack of confidence in their ability to change in the face of significant temptations to use likely tempered their overall improvement. Therefore, by helping those with anxiety increase their self-efficacy (confidence) and effectively address temptations to use, they could move from the contemplation stage and into the more action-oriented stages and achieve greater reductions in substance use. Therefore, clinicians should target self-efficacy early and often when treating anxiety sufferers.

This finding also helps to answer an important question identified in this dissertation: Which of the three primary treatment approaches (sequential, parallel, or concurrent), is most effective in treating substance use and anxiety disorders? As this dissertation suggests that the primary factor limiting effective treatment of those with these comorbid disorders was that individuals were unable to progress beyond contemplation due to a lack of self-efficacy, it seems logical that by first addressing this lack of self-efficacy, patients would improve in their substance use care. Therefore, it seems that initially a sequential treatment model where anxiety is treated first would be most ideal. However, another concern must be discussed before drawing this conclusion.

While treating anxiety first may increase self-efficacy, there is also the potential that engagement in anxiety treatment could exacerbate symptomology (especially in cases of PTSD), which might further drive patients to self-medicate through substance use. Moreover, by delaying substance use treatment, the client is potentially left facing mortal danger through the continued effects of the substance or possibly an overdose. With these

concerns in mind, the findings of this study suggest that a concurrent treatment model be used in treating those with comorbid anxiety and substance use disorders.

Implications for the Military

Because military members report higher prevalence rates of both anxiety and substance use, one benefit of this dissertation is that its findings are potentially applicable to military personnel, particularly the findings for the anxiety group. Findings that anxiety participants showed potential for even greater rates of improvement, so long as treatments are able to target self-efficacy concerns, is highly encouraging for military treatment programs. If military models treat some of the negative characteristics tied to anxiety, such as a lack of confidence, while concurrently treating substance use behaviors, military members are far more likely to internalize treatment and experience long-term benefits.

However, this study does not address some characteristics unique to the military population. For example, this study does not account for external factors, including coercive treatment methods such as mandated treatment models, in substance use outcomes. Since many military members (particularly active duty service members) must comply with treatment guidelines or face expulsion from the military, or possibly worse, such as confinement in a military prison, these external motivators are likely to have significant effects on treatment for this population and require further examination. A 2010 study by Ondersma, Winhusen, and Lewis found that external motivators, including potential incarceration, loss of child custody, and/or loss of subsidized housing,

effectively increased retention during treatment, and positively influenced substance use outcomes after 12 weeks. Therefore, it is likely that military participants mandated treatment will initially fair at least as well, if not better than participants in this study.

However, another study that examined the impact of external motivators on change conducted by Stotts and colleagues (1996), found something different. In this study, smoking cessation was examined comparing pregnant and non-pregnant smokers. Findings revealed that participants who relied on heavy external motivators to change (the health of an unborn baby), experienced significantly higher relapse rates than participants without such external motivators for change. Ultimately, although the pregnant smokers were able to move quickly into the action stage of change, they continually under-endorsed experiential and behavioral processes of change.

Clinicians should therefore be mindful of external factors in the military that may seem to facilitate change, but in reality, do not provide a lasting effect (such as mandated substance use treatment with the consequence of discharge looming as a consequence of failure). Instead, when working with a population that is heavily influenced by external motivators, clinicians must augment treatment in a way that capitalizes on the increased participation yielded through external motivators, while also supplanting external motivators with internal desires for change.

Lastly, it is important to note that because this study did not focus on any single type of anxiety, the findings cannot be considered generalizable to particular anxiety disorders. This is an important distinction because those who have served in and around the military are more prone to some types of anxiety including PTSD, than the general

population. Since this study indicated that anxiety's impact on substance use outcomes is drug specific, and because study limitations preclude identifying different anxiety disorders would impact each type of substance use, the impacts of various anxiety disorders on each of the various substances should be studied. In particular, researchers should examine PTSD's effects on alcohol use, as these comorbid diagnoses are highly prevalent among this population.

Limitations and Future Research Directions

This study is a step forward in understanding the relationship between anxiety and substance use disorders. However, several limitations of this study must be noted, along with recommendations of addressing them. First, while study findings are likely applicable to populations with similar demographic characteristics (younger Caucasian males, such as the military), results are not generalizable to the general population, which is far more diverse. Therefore, future research should target other populations in other environments.

Second, available data were limited for each substance. TTM construct data for alcohol was not obtained during the initial Project TIP study, making it impossible to compare the cocaine and cannabis findings with alcohol. Third, this study was also limited by the small sample size for cocaine (n=86), which made comparisons with cannabis difficult. Because alcohol and cocaine are such commonly used substances, a replication of this study using these and many other substances is needed.

Fourth, this study was based on a broad identification of anxiety symptoms using BSI subscale cutoff scores but was unable to specify or compare various anxiety disorders. Knowledge of how different anxiety disorders impact different substance would have substantial benefits for treatment planners. For example, future research for the military should examine the impact of anxiety disorders such as PTSD on substance use such as alcohol as these are commonly occurring disorders among service members.

Fifth, much of the study data relied on self-report, both for anxiety and for alcohol use via Time Line Follow Back (TLFB) procedures. Although self-report is considered an acceptable method of gathering data for these types of studies (Carey, Maisto, Carey, & Pumine, 2001), there are also weaknesses of self-report data. Participant must demonstrate a certain level of introspective ability, and even in cases where the participant desires to respond honestly, some may lack awareness (possibly due to recall bias) required to provide accurate accounts of behaviors. Additionally, self-report measures are susceptible to desirability bias, which drives responders to ascribe more positive traits to themselves, responding in ways that makes them appear more favorable (Nederhof, 1985).

Topics such as comorbid mental health diagnoses and substance use are particularly susceptible to social desirability bias (Furnham, 1986). Despite these drawbacks, self-report measures are a cost-effective way to gather large amounts of information from participants, as required in this study. Accordingly, this dissertation benefits from a strength of the TIP study, which accounted for these concerns by performing a

biochemical validation of substance use, results of which demonstrated congruency with self-reported use.

Lastly, although repeated measures analyses were able to compare anxiety and non-anxiety groups, neither profile nor latent growth curve analyses using TTM constructs were linked to substance use outcomes by group comparisons. Thus it was impossible to extrapolate a "successful profile" for those who reduced substance use compared to those who did not. Developing such a profile is another recommended action for future research.

VII. CONCLUSION

This dissertation set out to increase understanding of the complex relationships between anxiety disorders and substance use disorders. It began by identifying two significant gaps in the research. The first was that researchers have not sufficiently described anxiety's impact on substance use outcomes. Secondly, researchers have yet to examine how individuals with anxiety experience change regarding substance use compared to those without anxiety. Through t-tests, general linear model repeated measures and profile analyses, and, finally, latent growth curve analyses, this study is among the first to examine these concerns using TTM constructs.

Despite the study's limitations, the findings increase our understanding of the complex relationship between anxiety and substance use. One key finding was that anxiety's impact on substance use before, during, and following treatment is dependent on the drug being examined. This finding provides much needed guidance by directing future research to compare specific substances rather than lumping all substances into a single category. Another key finding was that anxiety and non-anxiety groups experienced change in different ways based on TTM constructs, also depending on the substance used, further emphasizing the need for researchers to be mindful of these differences.

A last key take-away is that there are distinct differences in how anxiety and non-anxiety participants engaged in the change process. Through a close examination of these differences, it seemed that, while both groups reduced substance use at a similar rate, the anxiety group potentially could have changed at a far greater rate by addressing self-

efficacy concerns early in treatment. This suggests that clinicians should avoid the "one size fits all" approach and tailor treatment regimens for those with anxiety. Specifically, in addition to assessing motivations to change, treatment providers should promote a client's or patient's self-efficacy throughout treatment to maximize gains for this population. Although this dissertation does not answer every question about the relationship between anxiety and substance abuse, it does provide valuable information for researchers and clinicians interested in helping those with co-occurring substance use and anxiety disorders.

Appendix

Anxiety disorder criteria

Adjustment Disorders	*DSM-IV-TR* Adjustment Disorder diagnostic criteria (APA, 2001): A. The development of emotional or behavioral symptoms in response to an identifiable stressor(s) occurring within 3 months of the onset of the stressor(s). B. These symptoms or behaviors are clinically significant as evidenced by either of the following: (1) marked distress that is in excess of what would be expected from exposure to the stressor (2) significant impairment in social or occupational (academic) functioning C. The stress-related disturbance does not meet the criteria for another specific Axis I disorder and is not merely an exacerbation of a preexisting Axis I or Axis II disorder. D. The symptoms do not represent Bereavement. E. Once the stressor (or its consequences) has terminated, the symptoms do not persist for more than an additional 6 months. *Specify* if: **Acute:** if the disturbance lasts less than 6 months **Chronic:** if the disturbance lasts for 6 months or longer Adjustment Disorders are coded based on the subtype, which is selected according to the predominant symptoms.
Generalized Anxiety Disorder (GAD)	*DSM-IV-TR GAD diagnostic criteria* (APA, 2001): A. Excessive anxiety and worry (apprehensive expectation), occurring more days than not and for at least 6 months, about a number of events or activities (such as work or school performance) B. The person finds it difficult to control the worry C. The anxiety and worry are associated with three (or more) of the following six symptoms (with at least some symptoms present for more days than not for the past 6 months). Note: only one item is required in children (1) restlessness or feeling keyed up or on edge (2) being easily fatigued (3) difficulty concentrating or mind going blank (4) irritability (5) muscle tension (6) sleep disturbance (difficulty falling or staying asleep, or restless unsatisfying sleep) D. The focus of the anxiety and worry is not confined to features of an Axis I disorder. E.g., the anxiety or worry is not about having a panic attack (as in panic disorder), being embarrassed in public (as in social phobia), being contaminated (as in obsessive compulsive disorder), being away from home or close relatives (as in separation anxiety disorder), gaining weight (as in anorexia nervosa), having multiple physical complaints (as in somatization disorder), or having serious illness (as in hypochondriasis), and the anxiety and worry do not occur exclusively during posttraumatic stress disorder. E. The anxiety, worry, or physical symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning. F. The disturbance is not due to the direct physiological effects of a substance (e.g, a drug of abuse, a medication) or general medical condition (e.g., hyperthyroidism) and does not occur exclusively during a mood disorder, a psychotic disorder or a pervasive developmental disorder.

SAD	*DSM-IV-TR Social Anxiety Disorder (SAD) criteria* (APA, 2001): A. Marked and persistent fear of one or more social or performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others. The individual fears that he or she will act in a way (or show anxiety symptoms) that will be humiliating or embarrassing. *Note*: In children, there must be evidence of the capacity for age-appropriate social relationships with familiar people and the anxiety must occur in peer settings, not just in interactions with adults. B. Exposure to the feared social situation almost invariably provokes anxiety, which may take the form of a situationally bound or situationally predisposed panic attack. *Note*: In children, the anxiety may be expressed by crying, tantrums, freezing, or shrinking from social situations with unfamiliar people. C. The person recognizes that the fear is excessive or unreasonable. Note: In children, this feature may be absent. D. The feared social or performance situations are avoided or else are endured with intense anxiety or distress. E. The avoidance, anxious anticipation, or distress in the *feared social or performance situation*(*s*) interferes significantly with the person's normal routine, occupational (academic) functioning, or social activities or relationships, or there is marked distress about having the phobia. F. In individuals under the age of 18, the duration is at least 6 months. G. The fear or avoidance is not due to the direct physiological effects of a substance (e.g., drug abuse, a medication) or a general medical condition and is not better accounted for by another mental *disorder* (e.g., panic disorder with or without agoraphobia, separation anxiety disorder, body dysmorphic disorder, a pervasive developmental disorder, or schizoid personality disorder). H. If a general medical condition or another mental disorder is present, the fear in Criterion A is unrelated to it, e.g., the fear is not of stuttering, trembling in Parkinson's disease, or exhibiting abnormal eating behavior in anorexia nervosa or bulimia nervosa. *Specify if*: Generalized: if the fears include most social situations (also consider the additional diagnosis of avoidant personality disorder).
Panic Disorders	*DSM IV-TR Panic Disorder (PD), with (and without) agoraphobia, criteria* (APA, 2001): A. Both (1) and (2) 1. Recurrent unexpected Panic Attacks 2. At least one of the attacks has been followed by 1 month (or more) of one (or more) of the following: a. Persistent concern about having additional attacks b. Worry about the implications of the attack or its consequence (e.g., losing control, having a heart attack, ‘‘going crazy’’) c. A significant change in behavior related to the attacks B. The presence (or absence) of Agoraphobia C. The panic attacks are not due to the direct physiological effects of a substance (e.g., a drug of abuse, a medication) or a general medical condition (e.g., hyperthyroidism) D. The panic attacks are not better accounted for by another mental disorder, such as social phobia (e.g., occurring on exposure to feared social situations), specific phobia (e.g., on exposure to a specific phobic situation), obsessive–compulsive disorder (e.g., on exposure to dirt in someone with an obsession about contamination), Posttraumatic stress disorder (e.g., in response to stimuli associated with a severe

	stressor), or separation anxiety disorder (e.g., in response to being away from home or close relatives)
*Panic Attack (symptom of Panic Disorders)	*DSM IV-TR Panic Attack (PA) criteria* (APA, 2001): A discrete period of intense fear or discomfort, in which four (or more) of the following symptoms developed abruptly and reached a peak within 10 min. 1. Palpitations, pounding heart, or accelerated heart rate 2. Sweating 3. Trembling or shaking 4. Sensations of shortness of breath or smothering 5. Feeling of choking 6. Chest pain or discomfort 7. Nausea or abdominal distress 8. Feeling dizzy, unsteady, lightheaded, or faint 9. Derealization (feelings of unreality) or depersonalization (being detached from oneself) 10. Fear of losing control or going crazy 11. Fear of dying 12. Paresthesias (numbness or tingling sensations) 13. Chills or hot flushes
Post-Traumatic Stress Disorder (PTSD)	*DSM IV-TR Post-Traumatic Stress Disorder (PTSD), criteria* (APA, 2001): A. The person has been exposed to a traumatic event. B. The traumatic event is persistently re-experienced in one (or more) of the following ways: • Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. • Recurrent distressing dreams of the event. • Acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur on awakening or when intoxicated). • Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event. • Physiological reactivity on exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event. C. Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by three (or more) of the following: • Efforts to avoid thoughts, feelings, or conversations associated with the trauma. • Efforts to avoid activities, places, or people that arouse recollections of the trauma. • Inability to recall an important aspect of the trauma. • Markedly diminished interest or participation in significant activities. • Feeling of detachment or estrangement from others. • Restricted range of affect (e.g. unable to have loving feelings). • Sense of a foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span). D. Persistent symptoms of increased arousal (not present before the trauma), as indicated by two (or more) of the following: • Difficulty falling or staying asleep. • Irritability or outbursts of anger.

	• Difficulty concentrating. • Hypervigilance. • Exaggerated startle response. E. Duration of the disturbance (symptoms in Criteria B, C, and D) is more than 1 month. F. The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning. *Specify if: Acute: if duration of symptoms is less than 3 months Chronic: if duration of symptoms is 3 months or more Specify if: With Delayed Onset: if onset of symptoms is at least 6 months after the stressor*.

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